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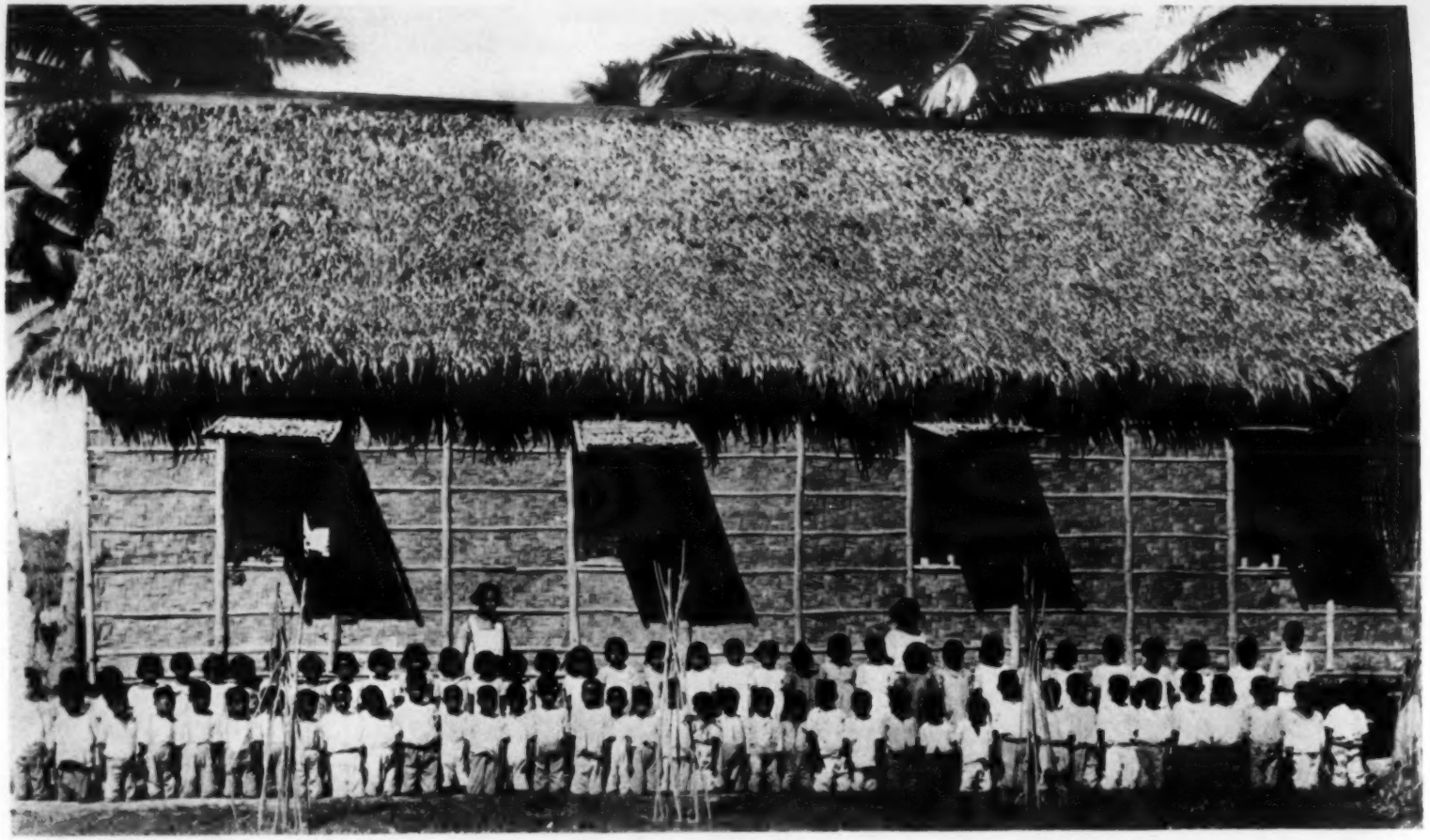

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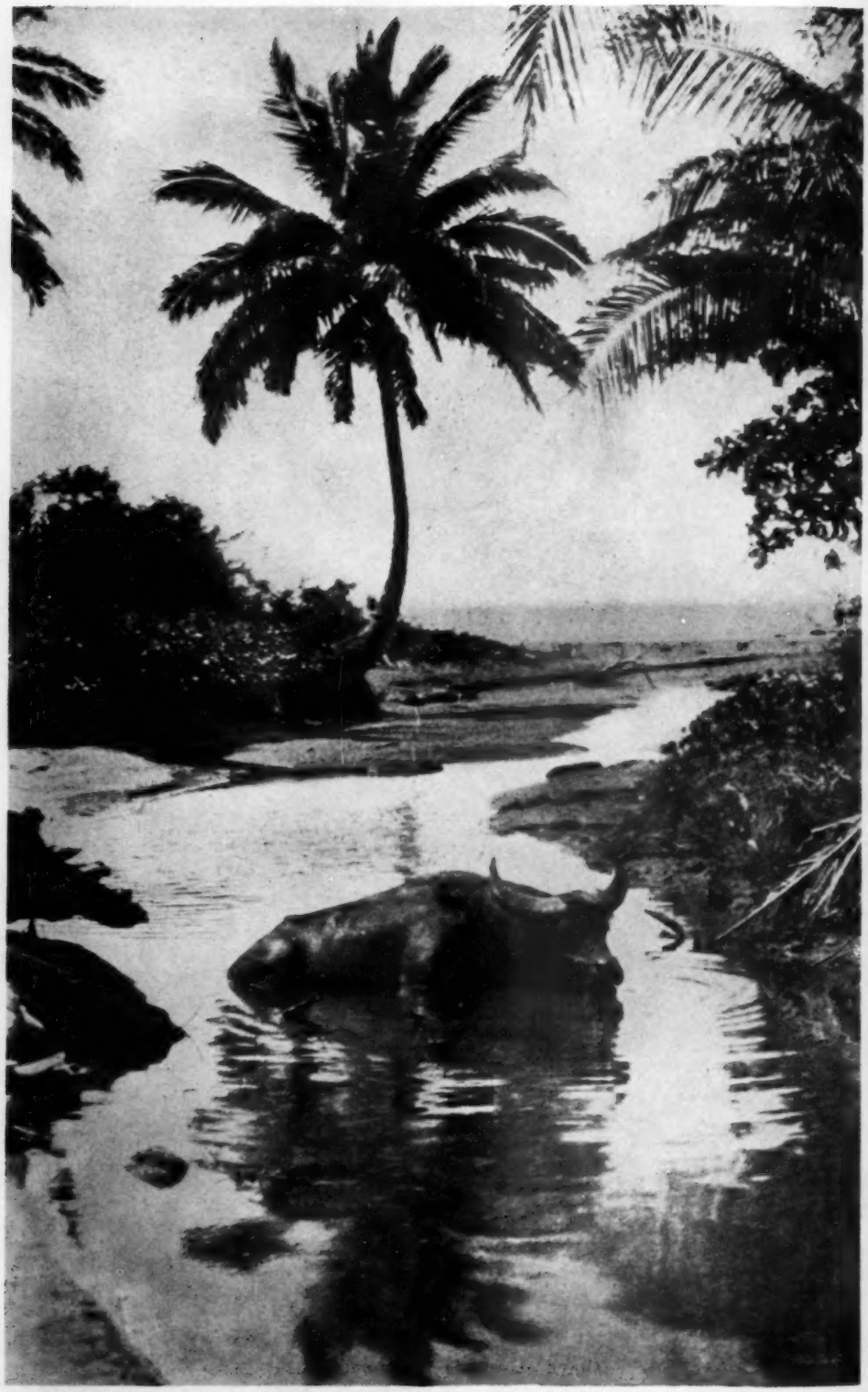

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NAVAL POLICY IN PEACE AND WAR

BY HOWARD G. BROWNSON, PH.D.

Si vis pacem para bellum.

FROM time to time, in the history of this country, it becomes necessary to radically alter naval policy, with a corresponding reconstruction of the fleet, in adjustment to changing national policies.

Such was the experience in the first naval program under the Constitution during the Adams administration when it became necessary to provide heavy cruising ships, frigates at that time, to protect American commerce against the attacks of revolutionary France and the Barbary pirates. This general policy continued in force until the Civil War, when the necessity of military operations against the Confederacy required development of a coastal type such as the *Monitor* and river gunboats in place of the seagoing cruising ship. Once inaugurated, this new policy continued until the growth of foreign commerce and relations required another change of policy in the famous White Squadron. Commencing with unarmored cruisers this program slowly developed into the armored ship of the Spanish-American War, and then, as the standard was set by England and Germany, into the battleship and ultimately the dreadnought, or all-big-gun type. In each case the shift in policy and construction followed a change in national policy: commerce protection under the federalist administrations and during the forties and fifties; coastal protection in the Civil War; and a combination of the two policies with expansion into the Caribbean. This policy reached its logical development in the strong naval program under President Roosevelt just prior to the World War.

Pre-war naval policy.—With the elimination of the Russian Navy by the Russo-Japanese War of 1904-05, the rapid rise of Japan, the decline of France, and the feverish competition between England and Germany the American fleet under the Roosevelt, Taft, and early Wilson administrations occupied a substantial third place; somewhat inferior to Germany and about half the strength of England. During this period the main point of danger was the Caribbean, with the newly developing Panama Canal; and the American possessions in the Orient, particularly Hawaii and the Philippines. British attention was completely absorbed by the rising German fleet, so that the primary American problem became that of battleship protection against the imperialistic policies of the German and Japanese Empires. Export of manufactured articles in competition with the Old World had only commenced, while the main items in over-seas shipping were raw materials of vital interest to England—cotton, foodstuffs, or the imports from England and her colonies—carried in foreign ship-

ping and protected by the British Navy. As a result, American naval policy centered on the defense of exposed strategic points such as the coast cities, the canal, and the Philippines; which requirement was met by a powerful coastal battle fleet consisting of numerous medium-sized heavily armed and armored battleships, armored cruisers, and a protective screen of light cruisers and destroyers. Submarines were still an experiment, while almost no provision was made for commerce operations.

The war program.—This policy of a substantial third place sufficient for local defense continued until during the first years of the war German and British interference with American commerce and the rapid growth of American foreign trade foreshadowed American intervention in the Old World. There was evidently already developing in the mind of the war president the program of world-wide American influence later expressed by the war against Germany, the fourteen points, "A World Safe for Democracy," and the League of Nations. At the time there was even more danger of war with England than with Germany, while the precedents of 1776 and 1812, as well as of 1845, 1862, and 1895, were influential in affecting a Democratic administration guided by a Scotch-Irish president, an Irish private secretary, and the Irish party chieftains of the northern states. But for the stupidity of the German military leaders the situation might well have followed similar conditions during the Napoleonic period leading to the War of 1812.

This situation came to a head in the winter and early spring of 1916 in two outstanding events:

The one, President Wilson's St. Louis speech of February 3, 1916:

> There is no other Navy in the world that has to cover so great an area, an area of defense, as the American Navy. And it ought, in my judgment, to be incomparably the most adequate Navy in the world.

The other, the forced retirement of the German High Seas Fleet at Jutland in the face of the concentrated British Grand Fleet.

These two widely separated and differing expressions, the one the words of the American president at St. Louis; the other the action of the battle fleets in the North Sea, brought home to the American public and to the world at large the importance of naval supremacy.

The result of these two influences was to radically alter the naval policy of the United States. Instead of continuing as a program of commerce protection as before the Civil War; of coast safety up to the Spanish-American War; or of limited defense of strategic points as under Roosevelt it now becomes a positive instrument of national action affecting the vital interests of the whole world. In the carefully chosen words of the President, the Navy of the United States must be *incomparably the most adequate Navy in the world.* This was not a standard of mere size or numbers, but a question of *adequacy* to enforce national policy. In other words, with the ocean barriers separating the United States from the Old World the Navy was to become the bridge whereby the rising strength of the Western world could be made effective in world affairs. *President Wilson's St. Louis speech marks the transition from a defensive to an offensive naval policy.*

From a technical point of view the Battle of Jutland, as the previous battle cruiser engagements, had shown the effectiveness of the powerful capital ship. The technical response of the United States to the supremacy of the British fleet was expressed in the naval act of 1916 providing for a new program of battleships and battle cruisers of unprecedented size and strength. In the words of an experienced newspaper correspondent (Frederick Moore in *America's Naval Challenge*, p. 1) *"In 1916 the United States began to arm against the eventuality of possible war with Great Britain."* In connection with previous construction this program of 1916 provided for a group of super-dreadnoughts decisively superior in size, armor, and gun power to anything possessed by England or Germany; besides a corresponding force of destroyers, submarines, and secondary forces.

Whereas the most powerful battleships England possessed were the ten *Royal Sovereigns* and *Queen Elizabeths* completed in 1915-16 of 27,500 tons (eight 15-inch, 42-cal. guns; 9- to 12-inch armor; 23 to 25 knots), and the two lightly armored battle cruisers of the *Repulse* class (31 knots; six 15-inch guns)—with the next class that of the *Iron Duke* (25,000 tons; ten 13.5-inch

guns) the American fleet in addition to the four *New York-Oklahoma* class, approximately equal to the *Royal Sovereigns*, would include seventeen battleships and six battle cruisers of from 32,000 to 43,000 tons, 14- to 18-inch armor, decisively superior to any existing British ships, viz.,

2	*Pennsylvania*	12	14″	31,400 tons*
3	*Idaho*	12	14″†	32,000 tons
2	*California*	12	14″†	32,300 tons
4	*Colorado*	8	16″‡	32,600 tons
6	*Indiana*	12	16″‡	43,000 tons
6	*Constitution*	8	16″	43,000 tons

* Some tonnage adjustment since authorization.
† 50-cal. guns.
‡ Originally planned for twelve 14-in., 50-cal.

As American resources were capable of rapid expansion of this program and there was available a strong support of powerful second line ships, the United States was placing itself in a position to fight its way through to such freedom of the seas as it might choose. Unlike the situation in 1812, American rights were to be protected by effective sea power. Moreover, at this time the German fleet was still intact with a high morale and at Jutland had shown its effectiveness against the more powerful Grand Fleet. England was thus placed between two strong opponents; the undefeated German fleet at Kiel and the potentially superior American fleet off the Atlantic. Moreover, the Pacific had been surrendered entirely to Japan; and the Mediterranean very largely to Italy and France. At the time, also, there was a strong sentiment for settlement of the war and a recombination of forces would probably result. German submarine action had not yet aroused the United States, and a possible combination with Germany, Italy, and Japan might make this country the deciding factor in world affairs.

The Wilson program of 1919-20.—With British concessions, the submarine policy of Germany, and American entrance in the war, naval policy during 1917 and the first part of 1918 was temporarily diverted to development of antisubmarine secondary forces, with close coöperation with England. However, with the surrender of the German High Seas Fleet; the collapse of Central Europe and Russia; the tremendous war program of the United States; and the development of President Wilson's policy of the fourteen points, national self-determination, and the League of Nations' sea power, as expressed in the battle fleet, again assumed preëminence, particularly in the peace negotiations at Versailles.

As the war progressed and American strength increased Wilson's international policy became increasingly clear and vigorous. With a natural personal dominance and as a virtual war dictator of the most powerful single military and economic power in the world he began to develop his program for universal democracy and world unity which was to find culmination in the League of Nations. Like Cæsar after Pharsala or Octavius after Actium, he was in position to dictate to a war-weary world *—a victorious democratic dictator establishing a universal constitutional democracy with popular support.* In this program the "iron hand within the velvet glove" was the American battle fleet.

As soon as the defeat of the Central Powers became imminent—in fact early in the fall of 1918—the Navy Department began preparations for completing the battle fleet program suspended by the destroyer and antisubmarine construction. One reason was the overwhelming *actual* supremacy of the British fleet under the able leadership of Admiral Beatty, reënforced by the best ships from the German Navy, a naval force greatly superior to all the remaining navies of the world. A second, and more definite reason, was to strengthen American influence at the coming peace treaty and readjustment of Europe. A third, though less immediate objective, was rebuilding battleship strength against the rising naval power of Japan.

> Immediately after the close of the World War the American government . . . began to expand the Navy on a scale unprecedented in our history or in that of any other country. For the first three years following the signing of the Armistice —that is to say, for the last years of the Wilson Administration—our country set the pace in naval construction, having on the stocks at one time more than twice as many new capital ships as all the other powers, great and small, taken together. (Moore in *America's Naval Challenge*, p. 3)

Upon the urgent recommendation of both the President and the Secretary of the Navy not only was the interrupted 1916 program to be completed, but the technical lessons of Jutland were to be embodied in reconstruction of these ships. In addition a second building program similar to that of

1916 was asked which would have given the United States twenty post-Jutland capital ships; forty fast cruisers; and twice as many destroyers and submarines as Great Britain. Wilson and Daniels had now swung to the other extreme of their early pacificism.

With the change from the traditional defensive policy, continued up to the World War, to the new international policy of President Wilson and the Democratic administration the character of construction, as of policy, was changed. Instead of the modest ten or fifteen thousand ton coast-defense battleships of the Roosevelt and Taft administrations there now developed the powerful post-Jutland 43,000-ton *Indiana* and *Constitution* deep-sea battleships and battle cruisers—huge floating fortresses with eight, ten, and even twelve 16-inch and potentially 18-inch guns; armored with 18-inch or more of the newest armor; and engined to out-speed as well as out-fight any corresponding ship in the world. In addition there were to be the fast *Omaha* cruisers, then considerably faster and more powerful than any similar type, and an extensive fleet of the new V seagoing submarines; besides over 300 seagoing war-program destroyers, and a number of anti-submarine craft. At the same time the ship building program was providing for around 500,000 tons of mercantile shipping a month. *The war had made the United States sea-minded.*

> The new ships were to be larger and more formidable than any ever before constructed. They were to have marked superiority over any vessels the British or Japanese navies possessed. They were to be able to sink the best British or Japanese ships before their fire could endanger ours. *It was to be a new navy completely superior to any other.* (Moore in *America's Naval Challenge*, p. 11.)

While some consideration was given to Japan, which had attempted absorption of China under the twenty-one demands, the primary purpose of this tremendous naval program was the driving home of President Wilson's proposal for world unification under the League of Nations, in which the United States by weight of its superior wealth, strength, and military and naval resources was to be actually though not nominally the dominant factor. It must be remembered that at this time the nation had a trained army of around five million men; war equipment and reserves to keep them supplied indefinitely; and shipping sufficient to convoy, land, and maintain this force in almost any part of the world. *The Navy was the spearhead for the establishment of American world supremacy.*

The Washington conference.—This program for the world supremacy of the United States—driven forward by the iron determination of the war president and backed by the unexhausted resources of the New World—was too stupendous for substantial support by the country: or rather, the personality of President Wilson was just lacking in those qualities necessary to achieve this vision. The situation was quite parallel to that existing in the Roman Republic after the final triumph of Julius Cæsar: he presented the vision of a universal common civilization, but neither the world nor the solid sentiment of the republic was quite ready for its realization. It required another half generation of war and anarchy before his more diplomatic nephew, Octavius, could realize this vision. Perhaps some successor to President Wilson will realize his vision of a world republic under the leadership of the United States.

Be that as it may, President Wilson's program for American leadership in the League of Nations was rejected by the nation decisively in the election of 1920; American tradition would not support adherence on any lesser basis; and the conservative Republican administrations of Harding, Coolidge, and Hoover came into power. With this change came another shift in national and with it naval policy.

In place of the dynamic and dominant personality of the idealistic Scotch-Irish student and college president representing the emphasis upon the rights of man over the rights of property, there came into power the less able but more practical and utilitarian Republican leaders representing in large measure the interests of the conservative property-holding classes of the industrial centers and agricultural communities. From the "dream" of world unity and universal peace the nation came back to the "normalacy" of a commercial and industrial program interested in realizing in the dollars and cents of business, the opportunities presented by the world upheaval.

There followed a natural adjustment in the naval policy of the nation. Where

President Wilson, with support of the less prosperous classes, was willing to involve this nation in possible war with England or Japan or both for the realization of the great ideal of human brotherhood, the more conservative Republican leaders, representing the propertied classes who would have to foot the bill, preferred peace to the danger of war. Accordingly, the ambitious and revolutionary naval programs of 1916 and 1919, insofar as they were still uncompleted, gradually came to a standstill.

The immediate turning point was the Washington conference of 1921-22. England and Japan—threatened with bankruptcy or a dangerous war by the gigantic naval program of the United States—were quite willing to compromise on a ratio of strength which left them secure in their respective fields of influence. To put it perhaps more bluntly, the United States, the British, and the Japanese Empires were disposed to gather around the table and exchange the glittering possibilities of world empire for the more substantial realities of peace, prosperity, and consolidation of their respective gains. The Washington conference was neither a move of lofty altruism on the part of the United States nor a weak surrender to the crafty diplomacy of the Old World. It was a practical, though extremely generous, businesslike adjustment of national differences through an adjustment of naval strength.

The historical situation after the death of Julius Cæsar may explain the conditions in 1921-22. With his death—as with the fall of Wilson in 1920—the growing realization of world unity was exchanged for the strong probability of bitter war between the successors to his power. No one faction was ready to assume this responsibility, so the three outstanding leaders, Anthony, Octavius, Lepidus, formed a triumvirate and, to use a modern term, "pooled" their interests. In other words, they found it more expedient to unite and divide between them the empire, still nominally governed by the Senate, than to fight. Eventually they had to fight the issue to its logical conclusion of a single government or actual division; but their action postponed the decision for several years.

That, in effect, was what was done at the Washington conference; though hidden under the more high-sounding terms of modern diplomacy. Substantially, the world was divided into three parts: the New World to the United States; Europe, with the British Commonwealth of Nations, to England; the Mongolian areas of Asia to Japan. No actual division was agreed upon, but it was effected *in substance* through limitation of naval armament and fortification of advanced bases. Practically with these limitations, no one nation could engage successfully in war with either of the others in their dominant areas.

From a naval point of view the result for the United States was cancellation of the 43,000-ton super-battleships; virtual surrender of the naval bases at Guam and in the Philippines; and withdrawal of the challenge to world supremacy. In effect, the nation returned, though on a much stronger basis, to the naval standard of the Roosevelt and Taft administrations, interrupted by the ambitious international policies of President Wilson.

If the Navy under the limitations of the Washington conference be compared with that existing prior to the World War it will be seen that it is a logical development of the naval policy commencing with the White Squadron of the eighties. As naval technique develops; as American interests broaden; and as competition becomes keener there is a steady and fairly progressive increase in size, strength, and radius of action. The unarmored cruisers of the White Squadron grow into the armored cruisers and medium-sized battleships of the Spanish-American War; then into the all-big-gun types of the pre-war period; and finally into the powerful battleships of the *Colorado* class. They still remain—in view of the increased radius of American interests—essentially coast defense ships. In this they are to be distinguished from the old ship-of-the-line of sailing days and the proposed *Indiana* and *Constitution* classes, as also the German *Ersatz Preussen;* which are essentially *seagoing* rather than coastal ships. Ships, even of the powerful *Colorado* and *California* class, can safely creep along only from one base to another, normally not more than 2,000 miles apart, and can remain only temporarily off an enemy's base. They are, as it were, a "glorified seagoing monitor" limited to operations close to fixed bases. In this they represent a coastal or defensive policy in distinction

from the seagoing ships of the days of Nelson, which could operate in distant areas; maintain their position off an enemy coast; or operate at will on the high seas. As ships increased in size and efficiency, as with the *Hood* and the proposed American super-battleships, they become distinctly *seagoing* battle units able to maintain their position on the ocean against both capital and secondary forces through their speed, endurance, main and secondary armament, and defensive powers.

While not a complete parallel, the difference between the *Colorado* and the *Indiana* or *Constitution* classes represents, to a considerable extent, the difference between the conservative and distinctly American policy of the Republican administrations from McKinley to Hoover, and the more radical and international policies of Wilson; probably of the Democratic party. In the first case, as previously noted, there is a gradual expansion from unprotected cruising ships, through armored cruisers and light battleships, to powerful *base fleets* represented by the *Colorado*. In the second case, as suggested in the discussion of the Wilson policies, there comes a revolution, or radical change from a coastal policy based on defense only to an offensive policy requiring seagoing fleets able to maintain supremacy on the high seas.

On the whole, in American history, the Democratic party has tended to swing between the two extremes of provincialism and internationalism, represented by the local yet universal character of the Declaration of Independence, with an appeal both to a traditional aristocracy on the one hand (Jefferson and Wilson) and to the masses (Jackson and Cleveland). The Republican party, on the other hand, has been predominantly representative of the commercial and propertied classes and has tended to pursue a more conservative policy. This difference is marked in naval policies as the respective parties come into control: the Democratic or popular party tending to swing either to the Jeffersonian extreme of "gunboats" or to the Wilson program of 43,000-ton *Indianas* and *Constitutions;* while the Republican party has tended to follow a more conservative course, as marked by the gradual rise of the Federalist and Republican navies.

Thus, the Washington conference marks a distinct change in national policies reflected in the changing attitude of the administration toward naval policy and construction.

The Geneva conference.—The Washington conference represented a sharp reversion to previous naval policy made by the conservative and realistic ministries coming into power after the war. For that reason it constituted a swing to the other extreme that, while temporarily easing the situation, left both general and naval policy unbalanced.

Unbalanced fleets.—The American fleet prior to the war, as those of England, Germany, and Japan, was the conclusion of a slow process of adjustment of construction to national needs, and formed within certain limitations a balanced organization of battleships, armored cruisers, scouting ships, destroyers, and auxiliaries. The naval programs of 1916 and 1919, together with the feverish war construction, left the fleet at the close of the war in an unbalanced position which would have been corrected upon completion of the entire building plan around 1923-24, with fast battle cruisers, heavy and medium battleships, fast cruisers, etc., together with a large reserve of destroyers, old armored cruisers, and old battleships. However, the Washington treaty by its arbitrary curtailment of new construction, scrapping of old ships, and limitation of bases left the fleet in a badly mutilated condition: at one extreme a group of slow but heavily armed and armored line-of-battle ships; at the other extreme various groups of very fast but unprotected carriers, light cruisers, and destroyers; but with no intermediate classes such as battle and armored cruisers, flotilla leaders, and fleet submarines. From a fighting value the effectiveness of the fleet was seriously impaired; especially, as the more slowly developed British and Japanese fleets were left intact in their balanced organizations.

Had the American fleet been compelled at any time prior to the present to have engaged either the British or Japanese fleets it would have been at a serious disadvantage.

Unbalanced technical conditions.—At the very time the fleet organization was left unbalanced by the drastic provisions of the Washington treaty the technical developments of the war—guns, armor, underwater and deck protection, speed, endurance,

secondary forces—were being absorbed by the various naval staffs; while the stimulus of conflict had encouraged new factors such as aircraft, submarines, coastal motor boats, Diesel engines. In the ordinary course of continued construction these lessons would have been incorporated in new ships, as the experience of Jutland was incorporated in the *Hood, Rodney,* and *Nelson.* However, with the complete cessation of new construction—leaving the program simply that of ships designed mainly prior to the experiences of Jutland—the American fleet was left in a distinct technical inferiority: a fleet with no actual war experience (all American actions were against submarines) in competition with war developed navies in England and Japan: later Germany, France, and Italy. The actual result has been that while the technical developments of the war were being utilized by the Old World nations in such construction as the *Ersatz Preussen;* the *Rodney* and *Nelson;* the British, French, Italian, and Japanese cruisers; flotilla leaders and seagoing submarines, the American fleet was based primarily on prewar design. In the one exception of the 8-inch treaty cruisers the standard was forced by the particular needs of England and Japan; while American operations required a different type. This situation also existed as regards fortifications, secondary defenses, naval bases, etc.

As a result of the Washington conference the normal adjustment of construction to technical developments was drastically suspended so that an awkward and unbalanced technical condition existed.

Unbalanced political conditions. — The governments agreeing to the Washington treaty came into power in the sharp reaction from the war and were almost immediately succeeded by others of different political views. Through the death of President Harding direction of American affairs was taken over by President Coolidge, with subsequent changes in the State and Navy Departments. Similar changes followed in England, with the Law, MacDonald, and Baldwin ministries; and in Japan. At the same time France, Italy, and Germany—reduced to a subordinate place at the Washington conference — commenced the reconstruction of their naval forces in such revolutionary types as the *Ersatz Preussen;* the 35-40 knot cruisers; large seagoing destroyers; and submarine cruisers. The naval, and with it the political, balance adjusted at the conference was thus disrupted; not sufficiently to result in war, but enough to cause considerable naval and political competition.

It was in response to these conditions that President Coolidge called the conference at Geneva in 1927. The attempt was foredoomed to failure. Both France and Italy declined to take part and without their cooperation there could be no adjustment between England and the United States on the vital matter of relative cruiser strength. Perhaps the one valuable result was the disclosure of real differences in point of view, which caused both the governments and the public to give more serious consideration to the whole problem.

The net result of the Geneva conference, as of the situation which it sought to correct, was a realization of the limited and artificial character of naval disarmament. With political agreement naval agreement was comparatively easy; without such agreement it would be futile and perhaps even dangerous to attempt limitation.

The London Naval Conference.—Almost immediately after the failure at Geneva the political situation was modified in all the important naval powers. In the United States Coolidge was succeeded by President Hoover—by tradition, temperament, and training a liberal conservative and advocate of peace. In England the theoretical pacifist, MacDonald, succeeded the conservative Baldwin. In Japan the liberal elements came into at least nominal control. In Italy Mussolini was sufficiently established to risk negotiations, while the French attitude was more conciliatory than in 1927. With this political situation as a background and with a limited program it was possible to iron out many of the difficulties which had arisen since the Washington conference.

The conference in 1930, as that in 1921-22, afforded a breathing spell whereby nations slowly drifting into conflict could meet and remove certain of the more irritating problems. From that point it was a success. On the other hand, the conference revealed the impossibility of any permanent agreement outside of a world unification able to enforce peace between conflicting groups. England, Japan, and the United States, having effected a virtual triumvirate

in 1921, were in a mood to adjust their differences and even to unite, to a certain degree, in bringing pressure on secondary naval powers. However, both France and Italy had reached a position of fundamental antagonism which could be removed only by the weakening of one or the other, or by sufficient external pressure to enforce adjustment. The first meant war; the second effective international authority. But situated as they are on the critical Mediterranean lines, their differences automatically upset the balance of power; with a latent possibility of their uniting in some form of a Latin confederation.

At the Washington conference the three major naval powers, the United States, England, Japan, had such an overwhelming superiority in both effective fleet strength and latent resources that they were able to dictate terms to the other nations, up to a point of national honor. At the London conference the situation was quite different. The limitations of the earlier treaty had greatly reduced the naval strength of the three major naval powers, particularly in the large class of semi-obsolete and secondary forces of especial value in minor operations, while the minor naval powers had either held their own or considerably increased their strength, as France, Italy, Germany. Moreover, technical developments during this period such as effectiveness of land air forces, the Diesel engine, high-velocity, small-caliber guns, lightweight and super steels, etc., have upset the technical balance between the various types of ships, while giving increased value to secondary and land forces. The net result was that the three major naval powers while able to agree among themselves, temporarily at least, had neither the political nor naval strength to force their program on the minor naval powers. As a matter of fact, it was Italy not England, Japan, or the United States which really determined the result at London. Reduction of battleship strength; limitations on carriers and landing decks; limitation of cruisers, destroyers, and submarines—these provisions increased the actual and potential strength of the minor naval powers at the expense of the three major powers. This fact was recognized in the "Escalator Clause," which virtually destroyed the value of the treaty as a limitation on armaments, except as a matter of general agreement. By involving the possibility of additional construction it also tended to upset the agreement between the three major powers.

Under these conditions, the United States finds itself in the midst of a fluctuating and unbalanced naval situation. Nominally, a definite limitation of naval strength is secured between England, Japan, and this country; but not with France, Italy, or any of the minor naval powers except Germany (controlled by the Versailles Treaty). Actually, the agreement is little more than an expression of good will. It sets a tonnage ratio higher than this country desires, with the strong possibility of its being raised still higher in case of any important naval developments in Europe. It does not secure commerce protection, because the total number of cruisers is utterly inadequate to protect the trade routes and meet the needs of the battle fleet. It does not even protect the Panama Canal and the rich coast cities because the British-Japanese combination of fast battle cruisers and carriers is such that a strong air force could be thrown suddenly against one of these strategic points; avoid the coast defenses; and perhaps do considerable damage before driven back by the landplanes, while the American carriers and cruisers without battle-cruiser support are too weak to afford protection at sea and the battleships too slow. Without forgetting important advantages, it may be said that the London Naval Treaty of 1930 partakes largely of the character of a sedative or opiate, which temporarily produces a sense of quiet without removing the cause of the malady. As a temporary relief until the causes can be removed it may have considerable value; but if it induces neglect of these causes because of the temporary quiet it may become exceedingly harmful. In other words, if the naval treaty is regarded as a temporary relief while the causes of international competition are removed, it has value; if it is regarded as removing the causes, which it does not, then it becomes dangerous.

The effect of the treaty can be seen in the results which have followed in the few months since its ratification. As noted above, its success came about because of the temporary conjunction of liberal governments in the United States, England, Japan, France, and the willingness to negotiate on the part

of Mussolini. Within the year of this meeting each of these governments, except that of Mussolini, has either been defeated (as in France) or has approached very close to such defeat, as in the United States and England. In 1921-22 there was a marked conservative reaction from the war represented by the conservative governments of Harding, Law, etc. At the Geneva conference the shift had already set in towards liberalism. At the London conference this had developed into a temporary conservative-liberal supremacy. Since the signing of the treaty this liberal and democratic swing has grown rapidly—as evidenced by the German and American elections—with further possibility of a strong ultra-conservative reaction which may result in temporary dictatorships or "strong" ministries in those nations suffering most from the post-war adjustment. Moreover, during this past year there has been a severe international economic and industrial depression upsetting the economic and political conditions throughout the world. Thus, hardly before the ink has dried on the ratifications, the conditions bringing about this treaty have been altered so that its results are problematical. There may be, as seems to be developing in the United States, a tendency to keep well below the standards permitted. On the other hand, a change of ministries in England, France, Italy, Japan, Germany, or Russia may bring these nations to the point of important military and naval preparations, or even actual war.

In effect, the London Naval Treaty has settled nothing.

The Present Situation

Present naval policy of the United States.—If the answer were to be frank it would be—*none*. For the years immediately following the Washington conference the administrations of Harding and Coolidge were content, which was perhaps wise, to merely complete the provisions of the war programs as they were modified by the treaties; with delayed construction of eight 8-inch cruisers in response to Old World developments. The fifteen-cruiser program, passed over the opposition of Presidents Coolidge and Hoover in the change between the two administrations, was voted to a considerable extent as a bluff to force concessions from England. The naval treaty was ratified by the Senate by a large majority in the face of determined opposition. Sentiment in Congress and throughout the country seems strongly inclined against conformity to the requirements of the treaty so far as new construction is concerned. With a clear inferiority to England and even to Japan in modern secondary forces (cruisers; seagoing destroyers; fleet submarines; auxiliaries; and new carriers) the general trend on the part both of the administration and of Congress is to limit new construction to an amount that hardly replaces the obsolescence of the pre-war cruisers. To that extent there is a naval policy—but one distinctly negative.

Even in the Navy Department itself there seems to be no clear policy. The strenuous conflict between advocates of the 8-inch and 6-inch cruisers, and the slow program of construction and reconstruction show that naval opinion is not united. Tradition and momentum favor certain policies—as heavier guns—but seemingly with only a limited consideration of the basic strategic problems involved. There is no definite policy as to a probable antagonist, except a general technical opposition to the British and Japanese Navies.

Pacifist opposition.—In the face of this negative naval policy of the administration and Congress there exists a pronounced and militant opposition to any increase whatever in the Navy, certainly as to new construction, and, in increasing measure, even to maintenance of the existing standard. Much of this opposition is purely emotional and, as in the campaign against the saloon, considers the Navy as the visible sign of the evil of war—to be restricted and eventually blotted out. Behind this movement, however, there is a considerable amount of clear and often brilliant reasoning which favors internationalism and would limit naval strength as a center of nationalism. Combined, these two movements possess sufficient strength to block, under existing conditions, any clear naval policy.

Political uncertainty.—In the previous pages it has been noted that naval policy reflects quite closely changes in political policies, subject only to the natural inertia of such a fixed and traditional organization as the fleet—viewed both materially and as an organization. The situation is that the country at the present time is at a *dead center* in the swing between liberal and conserva-

tive tendencies. Since the Harding landslide in 1920 there has been a steady swing towards liberalism; first affecting the Republican organization and now beginning to support that of the Democrats. In the Congress elected in November, 1930, there is an almost even balance between the two parties; with sufficient opposition from both to the administration to tie up all but routine administrative policies. It seems reasonably certain that the period from now to the 1932 election will be marked by a constant political agitation preventing any constructive legislation except of an emergency or special character; particularly as regards such disputed matters as the Navy.

The world situation.—What exists in the United States is a symptom of conditions throughout the world. Germany and Russia are on the verge of an outbreak at any time; China is in chronic disorder; India is seething with revolt; the Mohammedan world is quiescent, but liable to break forth upon sufficient provocation. Poland, Italy, Yugoslavia, Spain, Hungary, Turkey, and most of the Latin American nations are ruled by military dictatorships. England is facing a more difficult internal situation than has existed for generations, with the probability of a new election and a political readjustment. Japan is nominally quiet, but the extent of unemployment and internal dissatisfaction may cause serious disturbance. France alone of the major powers, together with Italy under Mussolini, may be regarded as reasonably stable; but these two nations seem drifting towards war. Of still greater significance is the almost universal economic depression, which both aggravates the political situation, while aggravated by the inability of fluctuating governments to take steps necessary for readjustment. On the whole, therefore, the world is in more of a transition than at any time since the immediate post-war period, without the strong stabilizing influence that came from the successful war governments in England, France, Japan, the United States, and the British Dominions.

In one sense the situation is not so serious as preceding the French and Russian Revolutions—with their extreme wretchedness—but sufficient unrest, unemployment, and dissatisfaction does exist to make it probable that there will be considerable readjustment and perhaps revolution and warfare before balance and peace are restored. The general situation is that of unbalanced forces in which a slight movement in one place may set the whole mass into commotion; which may easily lead to a succession of minor and even major wars.

Just how serious conditions are no one really knows. Things may quiet down; on the other hand, as Bywater and Gibbons suggest in their war stories (*The Great Pacific War; The Red Napoleon*), the world may be entering upon a revolutionary period quite comparable to that preceding the French Revolution.

Naval preparedness.—At such a time it is futile to outline any clear-cut and definite program; because it is reasonably certain it will not be approved. The present is a period of unbalanced forces: political, economic, social, technical, racial, naval, military. It is impossible to predict from just what direction danger may come. Opinions and even sound judgment may suggest various remedies, but the probability is they will either not be understood or if accepted cannot be put into effect.

However, in a period of transition as the present there are certain suggestions which should prove of value:

Historical study.—As the problems of the past are understood and mastered the mind becomes accustomed to these periods of fluctuation and realizes the permanent within the transitory. Therein lies the value of Mahan, as well as the large number of able but more detailed historical studies. From Alexander studying philosophy at the feet of Aristotle and carrying a copy of Homer under his pillow on his campaigns on down through the ages to Mahan in the Spanish-American War or Churchill, Wilson, and Foch in the World War—study, particularly historical study, has formed the basis of achievement.

Technical conditions.—The very rapidity of technical changes makes it imperative they be understood. Such developments as the Diesel engine, the airplane, high-velocity and high-angle fire, fast torpedo craft, super steels are revolutionizing the whole mechanical technique of naval warfare. From changes in tactical and technical conditions they affect the expression, though not the principles of strategy, and make necessary a whole new theory of operation; which itself may change with the rapidity of mod-

ern technical changes, just as the automobile is revolutionizing modern life.

Political conditions.—To the naval officer especially it is important that political conditions, both at home and abroad, be clearly understood. As noted in this paper, the various political changes in the nation have determined not only the character of naval policy but even the types of ships and their construction. Therefore, it becomes essential that political conditions be followed and understood, not from a partisan point of view, but rather that from a knowledge of history and human nature the future may be understood in the light of the past and of the present.

Whether for the naval officer individually; for the various bureaus of the Department; or for the Navy as a whole, a time such as the present of seeming confusion may be most profitable in laying the foundation for a proper understanding of historical, technical, and political conditions; which will bear fruition in the years that are to come—just as similar periods laid the foundation for the work of Mahan, Scott, and Sims in preparing the British and American Navies for the World War.

Finally, it becomes important that events and movements and personalities be understood in their proper relation to each other. In the previous pages it has been seen that a single personality, President Wilson, tremendously altered the character of American sea power. The same was true in England with Churchill, or in Germany with von Tirpitz. History and science show the broad trend of events; personalities determine the action. It is in the combination of the two that history develops: sometimes on a large screen as with Napoleon; sometimes, and more often, in the daily course of ordinary routine.

Conclusions

This paper has taken up in a general way the growth and development of the Navy in relation to the political policies of the nation. As the nation has swung backward and forward between a political and a commercial program according to the respective influences of the Democratic or Republican parties, so the naval policy has alternated from one course to another. On the one hand there has been slowly developing—as an inheritance from England and the Revolutionary Navy—the tradition of a seagoing cruising and battle fleet primarily for commerce protection; on the other hand, there have been violent fluctuations, either towards the extreme of pacifism represented by the non-intercourse acts and gunboats of Jefferson, or the militant navalism of Wilson represented by the 1916 and 1919 Navy Acts and the 43,000-ton *Indianas* and *Constitutions*. Between these extremes the Navy has been forced to pursue a difficult and at times confusing policy, often of routine and national neglect.

At the present time the nation, and with it the Navy, are entering upon a probably short-lived period of rather extreme fluctuation; represented on the one hand by militant pacifism, and on the other by an equally militant big Navy group. Between the two, as in the period preceding the war, the Navy will probably be maligned, neglected, and disorganized; it is this very period, however, which prepares the way for the decisive action of the subsequent crisis.

In time of peace the Navy must prepare for war.

Note: The French-Italian naval agreement being negotiated under British pressure since this article was written requires careful study as indicating the possibility of another shift in international relations: return of England to a continental policy; a possible British-French-Italian entente; growing isolation of the United States; and a tendency towards temporary unification of the Old World under British leadership.

HAPPY LANDINGS!

By Lieutenant P. E. Pihl (C.C.), U. S. Navy

HAPPY LANDINGS! is the universal toast among aviators.

The significance of that toast is deeply rooted in the peculiar characteristics of the airplane and its uses. For, unnatural as it may seem to the uninitiated, it is not the departure from *terra firma* that presents the greatest difficulties in the training of the new aviator, or the daily work of the seasoned pilot, or the design of the vehicle that either is given to fly. The take-off of any airplane is relatively simple. It is the return to the natural element, the landing of an airplane, which is fraught with the greatest hazards, presents the greatest complexities in acquiring mastery of its accomplishment, and furnishes the stumbling block which many otherwise promising designs of airplanes fail to surmount.

According to the latest statistics, 31 per cent of all accidents in naval aviation for the past year occurred in connection with the act of landing. The Department of Commerce reports, for the same period, show a similar proportion of landing accidents. These figures, in themselves, bespeak the necessity for the most painstaking attention to every detail of human or mechanical performance involved in the problem.

How numerous are these details and how elaborate are the measures taken to cope with them, few people realize. By way of illustration, consider the provisions made by the Navy in the training of its pilots and in the design of its airplanes to ensure to the former the maximum number of happy landings.

First is the all-important selection of candidates possessing the requisite mental and physical characteristics to qualify them as material of which to make naval aviators. Naturally, these characteristics are quite different from those which are indicative only of probable ability to fly, though they include the latter. In consequence, a preferred group of individuals is presented for preliminary training, and yet, it will be noted, no detail of their subsequent training or service flying can be overlooked in the attainment of their ability to land. In the course of their physical examinations certain features bearing specifically on the ability to land are investigated. Among them are those of muscular coördination, sense of balance, normal vision, color perception, and the extent to which each makes use of his natural binocular vision in the fine degrees of depth perception. Not only is such an examination given in the process of selection of candidates, but it is repeated for the successful ones before the actual commencement of flight training; and, during the entire flying career the same check on physical equipment is made at least once a year.

The next step is the preliminary flight training, or so-called elimination training, which is given at the two fleet air bases. This consists of ten hours of dual instruction of which more than 80 per cent is devoted to teaching how to land. Fifteen or twenty times an hour, and hour after hour, during this period the act of landing is repeated. Each little detail of the gliding approach, the break in the glide, the leveling off, the full stall, the landing, the speeds involved in each stage, the disposition of controls, and the judgment of exact height when close to the ground is carefully labored, criticized, and rehearsed. The purpose of the elimination training is to make a preliminary determination of a candidate's aptitude for flying, and chiefly, whether he can learn to land without assistance and with a degree of safety such as to warrant permitting solo flight.

Successful completion of this stage brings the opportunity to enter upon the complete course of instruction offered at Pensacola. Again, the first assignment is a period of dual instruction which is replete with gliding and spiral approaches to landing coupled with all sorts of emergencies in the nature of "cut guns," difficult attitudes, and embarrassing positions relative to obstacles on the ground or water. In progressive stages the

course proceeds, each stage furnishing new details of the act of landing, interspersed with numerous practical examinations in flying to demonstrate the proficiency acquired. Long before the final completion of the course, the student has learned, first, never to lose flying speed at any stage of the landing, except just as he is ready to let the plane settle in the final short drop of not over two feet. He has learned to make all landings, where any choice exists, into the wind. Quarter spirals, half spirals, full spirals, and the altitude consumed by each, as well as the straight glide, with the angle necessary to maintain proper flying speed and the consequent length of approach covered in the glide, have become familiar factors of every landing. In addition, he has learned how to lose altitude quickly in an approach by side-slipping, or how to lose excess speed by fishtailing. He has learned how to make use of these when forced to land cross-wind or with the wind. During the course he has made innumerable precision landings shooting at a mark on the field or a buoy in the water. He has demonstrated his ability to use all of the variations in the approach to landing by making landings from various altitudes, with a completely switched-off engine, and coming to rest within 200 feet of a designated mark or touching his wheels to the ground on a designated line. In addition, he has repeatedly demonstrated his ability to think quickly in the case of all sorts of artificial emergencies imposed by his instructor or check pilot and to alter the normal method of approach to landing to that most suited to the particular emergency condition. And last, as well as first, he has been taught, and presumably has ingrained in his nature, never to lose flying speed at any stage in the approach to landing, under penalty of involuntary, and possibly disastrous, loss of control.

The subsequent service career of a naval aviator entails a constant practice of all that was taught at Pensacola. In addition, it requires frequent relearning all the old principles in new forms as applied to new types of airplanes and modifications made necessary by changes in design of equipment, as, for example, in the case of the use of brakes and tail wheels. Then, there is the entirely new procedure to be learned by the pilot assigned to a squadron based on an aircraft carrier. Here he must learn to make his approach strictly in accordance with the manner indicated to him by the signal officer, who, by means of flags, informs him whether his approach is too high or too low, too fast or too slow. When he has passed the stern of the ship he must so place his airplane relative to the deck that the arresting gear installation of both the plane and the deck can function as designed and bring him to rest in the limited space offered by the landing area of the deck. And this is not all. He must be able to make his approach and landing in the most expeditious manner possible in order that he will not contribute any delay to the landing of the forty, fifty, or sixty planes following behind him, which must be landed so that the military effectiveness of the ship will be a maximum. However, this type of landing is a highly specialized case and somewhat beside the point. The greatest part of his time as a naval aviator he is concerned with the kind of landing which he first learned, that on the field or surface of the water. Here he brings into play daily most of the factors mentioned. As his total of flying hours mounts, some of these lessons become so thoroughly mastered as to become subconscious acts as natural as those of guiding an automobile are to the man on the ground.

But so much for the details of human performance associated with landing. Enough have been noted to make clear that the pilot has plenty to think of even in a normal landing, and immeasurably more in the case of a forced landing where the choice of terrain may be so restricted that the most minute detail of the course elected may spell the difference between disaster and safety.

Now, in what way is the design of an airplane prepared to provide for the many exigencies of landing and to facilitate the pilot's performance?

The first preliminary to any airplane design is the mental picture, conceived by the designer, of the type of plane he wishes to build and certain characteristics of form, dimensions, and performance which he believes or hopes he can attain in the design. These ideas are transferred to the drafting board and to the preliminary estimates or calculations. Then begins the process of reconciling all the elements of the design to each other and to the whole. The first of the interrelated factors to be considered are

weight, speed, wing form, and wing area. Supported by the designer's experience and his familiarity with that of others, a weight estimate is prepared taking into account the similarity of the preliminary sketch to known types, on which weight data are available, and considering the classes of materials to be utilized. Then, since the total lift of the wings must equal or exceed the gross weight of the airplane, and since lift is equal to the product of the lift coefficient of the wings times their area times the square of the speed of flight, a relationship between weight, speed, and area must be established such that this fundamental principle of flight will be satisfied. The speed referred to is the minimum speed of flight and is practically synonymous with the speed of landing. In consequence, it is apparent that, early in the design the question of the landing characteristics projects itself to the discomfiture of the designer. He knows that the landing speed must be as low as possible to provide safety and comfort for the personnel flying the plane, to ensure that it can be landed within the confines of the normal landing areas, and, chiefly, to keep the dimensions (weight) of certain portions of the structure within reasonable limits. His general engineering education has taught him that high speeds of contact with the ground are associated with high loads in the entire structure, which, in turn, call for greater strength, the penalty for which is weight. Since, in the fundamental equation, the factor of speed appears as the most influential factor, being raised to the second power, any restriction placed upon it is immediately reflected in the necessity for a disproportionate enlargement of the weaker factors, lift coefficient or wing area. Here we find the necessity which has mothered the incessant search since the origin of flying for more and more efficient forms of airfoils, surfaces which will by their shape and effect upon the air flow, increase the lifting capacity of the wings at little or no expense in weight. Having selected the airfoil most suited to his design, based on the consideration just noted as well as that of resistance and its attendant effect upon the high speed and performance of the plane, the designer can readily calculate the total lifting area required to support the estimated weight. At this point the first adjustment enters, namely that of determining whether the total wing area can be built for the weight estimated in the beginning.

Similarly the choice of wing area, wing form, and landing speed must be investigated in connection with total resistance of the plane and its weight to find what the gliding angle will be at, or slightly above, the landing speed, and whether this angle is such that the average pilot can guess correctly the point to commence his glide with assurance that he will land on the field. In this particular, it must be admitted that present-day planes tend to retrogress, in that the usual gliding angles, associated with the lowest safe speed, are too flat. It has frequently been pointed out that it is impossible for even an experienced pilot to judge his exact height within a hundred feet at altitudes above 500 feet. Yet at altitudes between 500 and 1,000 feet, where the approach to landing is generally started, an error of 100 feet in the estimation of height means an error of roughly 1,000 feet beyond or short of the mark on the ground, if no change is made in the gliding approach. Since the total available length of many fields is less than 2,000 feet, the gravity of the possible error is apparent, particularly when dependence cannot be placed on the use of the engine. It explains why seasoned pilots sometimes overshoot a field, and why many a famous flight has come to grief by its termination through the fence because fatigue has so dulled the pilot's faculties of judgment of gliding angle, speed, and altitude, that he has failed to maneuver quickly enough to avert such a disturbing anticlimax.

It is interesting to note in connection with the design features bearing on landing characteristics that the Daniel Guggenheim Foundation saw fit to lay down rules for its safe plane competition, which specified that a plane must be able to land at a speed of not over thirty-five miles an hour, glide at an angle of not less than sixteen degrees below the horizontal without exceeding forty-five miles an hour, and be able to approach over an obstacle thirty-five feet high and come to rest on the ground within 300 feet from the base of that obstacle. Further, the safe plane must be proof against involuntary spinning due to loss of flying speed or nose-high attitudes imposed by an inexpert pilot. In response, the Curtiss Company developed a plane which won the competition

by complying with every demand of the rules. This was made possible by the incorporation of such modern safeguards as wing slots, by which lift is maintained at high angles of attack considerably above those at which most planes stall and fall off in a spin; wing flaps, by which steep gliding angles can be maintained without accumulating excessive speed; floating ailerons, by which lateral control and stability of a very high order are secured even at speeds considerably below the minimum flying speed; and, lastly, by a very rugged landing gear, with particularly effective shock absorption, capable of withstanding "pancake" landings from any height. One by one, these features, or their derivatives, are certain to be adopted in future planes, unless new methods are found to accomplish the same ends by means as yet unknown or that are considered impractical in their present form.

Leaving the designer, temporarily, in his striving for the plane of the future which will be as easy to land as the present automobile is to park at the curb, let us next consider the portions of the airplane structure called upon to bear the loads of landing.

The present land-type landing gear consists of wheels with pneumatic tires, a supporting carriage built up of struts, and means for absorbing shock. In most cases wheel brakes are included. The wheels may be either wire-spoke or disc type. The tires range from the small diameter high-pressure type through various stages of low pressures and larger diameters to the ultimate in low-pressure construction, a tire which has no other wheel than the large hub on which it is mounted. The undercarriage is now almost invariably made of metal struts which may be either round tubes, with or without streamline sheathings, or pressed tubes of streamline shape. Shock absorbers are generally telescoping cylinders, or cylinder and piston arrangements, compressing against air, oil, or both to absorb the impacts of landing and taxiing over rough ground. In some cases auxiliary metal springs are included. The wheel brakes are almost as diversified in form and operation as the numerous varieties found in modern automobiles. The complete landing gear is a very different assembly from the elementary wooden skids employed on the first airplanes. And, though it weighs considerably more than the primitive form, it is in keeping with the heavier, faster airplanes of today and provides the ease and comfort demanded by modern ideas. In the development of the present forms, the designs have progressed through the stages of flimsy wheels, wooden struts, rubber shock absorbers, and general structural weaknesses which made landing a fine art requiring a happy combination of alert faculties in the pilot and first-class surface conditions on the landing field. Incessant testing of each new development in landing gears as it appeared has contributed to the success of the forms now in use. This testing for the Navy is still in progress on a large scale in the experimental division of the Naval Air Station, Hampton Roads, Virginia.

In corresponding fashion, the tail gear has developed from the elementary wooden stick or skid and its later counterpart of metal with the refinement of a shock absorber of rubber cords, to the present type made permissible by the advent of wheel brakes. As it now stands, the tail assembly consists of a wheel with a supporting metal structure and means for absorbing shock, generally a replica in miniature of the shock absorber cylinders employed in the landing gear. The wheel may be equipped with a solid tread of rubber or pressed fabric, or may have pneumatic tires similar to the landing gear wheels. It is generally made free to swivel through any angle to facilitate handling the plane on the field or in the hangar. The tail skids which ploughed a furrow across the field at every landing are rapidly becoming as obsolete as the high-pressure tire on the automobile, and landing fields of the future may soon be planned for a surface of turf with assurance that its pleasing carpet will not be converted to a barren, dust-ridden waste. The use of tail wheels necessarily demands wheel brakes and further that they be entirely reliable and efficient. When these demands are met, as they are in many modern installations, a far more satisfactory and maneuverable landing gear is provided than was ever possible with the old-fashioned types. As in the case of the landing gear, incessant testing has brought the development of the tail gear to its present forms. It still continues, for as yet no standard form has been evolved, nor has any one type demonstrated such outstanding qualities as to make its adoption exclude the consideration of others.

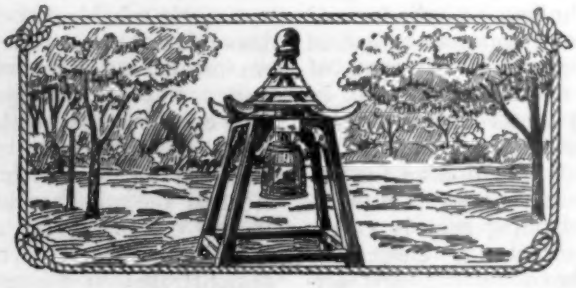
In the design of the structure intended to accomplish the landing, and its relation to the rest of the airplane structure, the designer must give the most scrupulous attention to the factors of weight, strength, and resistance. To ensure that no weight be wasted, nor that strength be sacrificed, specific rules have been laid down for the manner of computing the maximum stresses induced under certain normal conditions. To correlate these conditions with those obtaining under extreme conditions, these stresses are multiplied by a load factor determined from theoretical test, and service experience. Then to allow for a margin of safety, or factor of ignorance, they are again multiplied by a safety factor and the final result constitutes the basis on which the actual dimensions of each part are determined. Wherever possible the final form is designed, in addition, to conform with shapes which present a minimum of resistance to the flow of air around them and to offer a minimum of interference in the air flow around one member with that around an adjoining one.

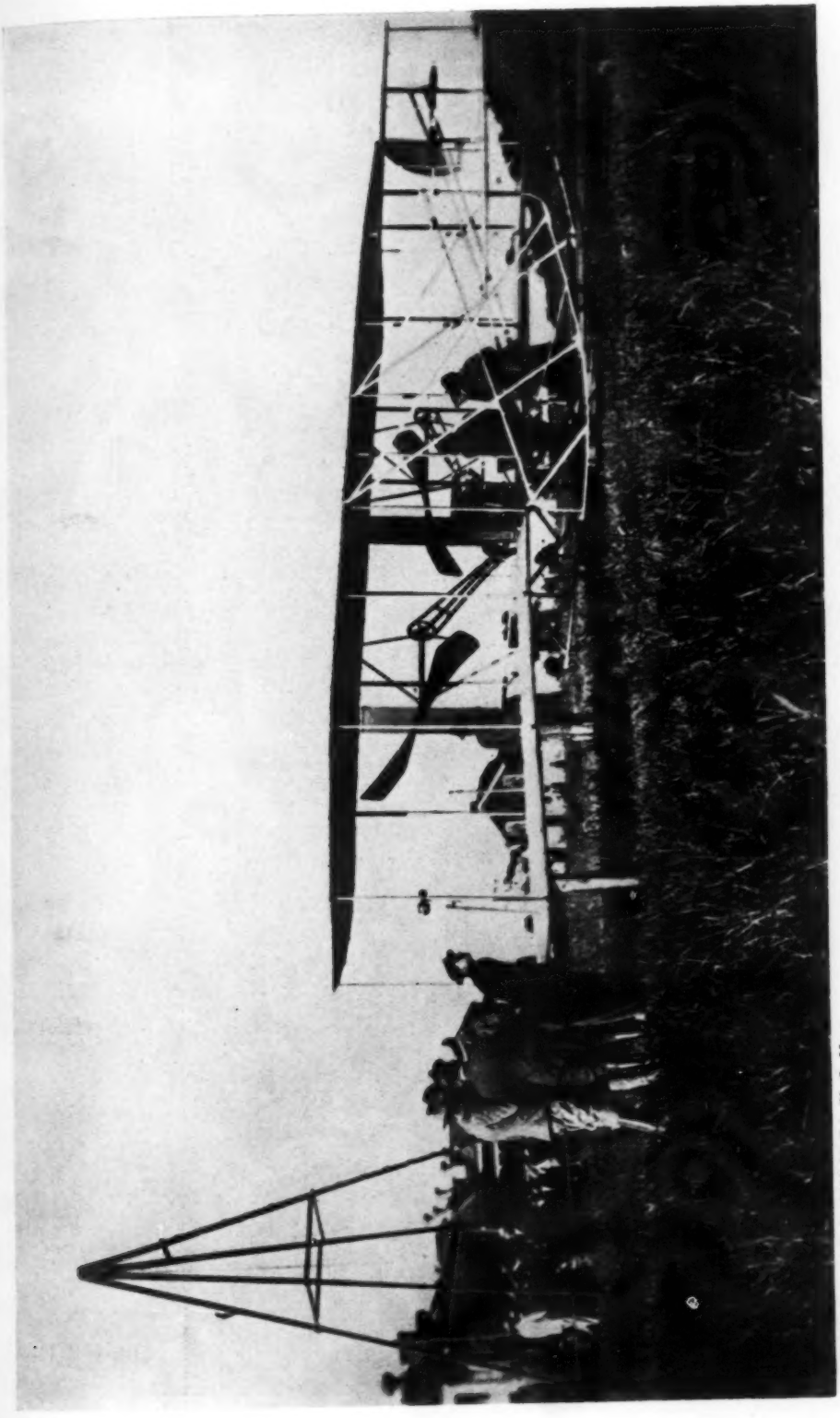
The specialized case of airplanes intended for landing on an aircraft carrier requires additional attention to the kind of arresting gear installation to be put in the plane and again the considerations of strength, weight, and resistance are similarly studied.

The discussion of landing gears has so far been confined to the land type principally because it suffices as an illustration of the varied problems involved in their design. A similar list could be given in the case of aircraft intended for operation from the surface of the water, such as flying boats, seaplanes, and amphibians. Here new factors of buoyancy, hydroplaning characteristics, spray throwing, stability, etc., must be considered in addition to those incidental only to landing. Similarly the choice of metals to be used in the structure and of protective coatings required to minimize the corrosion induced by repeated contact with fresh or salt water offers added complications. Again the practical solution can only be obtained after careful design followed by testing under full-scale operating conditions. The variety of the work assigned to the experimental division at Hampton Roads in relation to the one problem of landing is therefore readily apparent.

The problems involved in landing which have been noted so far, bear, in turn, on another group—those associated with the surface to be presented for the normal operation of the airplane. The field facilities are distinctly influenced by the changing designs of airplanes and their landing characteristics. Clear approaches, smooth surfaced runways in sufficient number and direction to meet seasonal wind conditions, landing lights, flood lights, obstruction lights, wind indicators, and guiding beacons are modern field accessories to assist in the landing of airplanes by day or night. Each is the product of careful thought and experiment and in some degree or other reflects the influence of the changing characteristics of the airplane.

Considering the diversity of human, mechanical, and natural complexities associated with the subject, and the ramifications of engineering, construction, and maintenance which bear on it, is it any wonder that the fervent toast of one aviator to another is the terse expression—"Happy Landings?"





Courtesy Lieutenant P. E. Pihl (C.C.), U. S. Navy

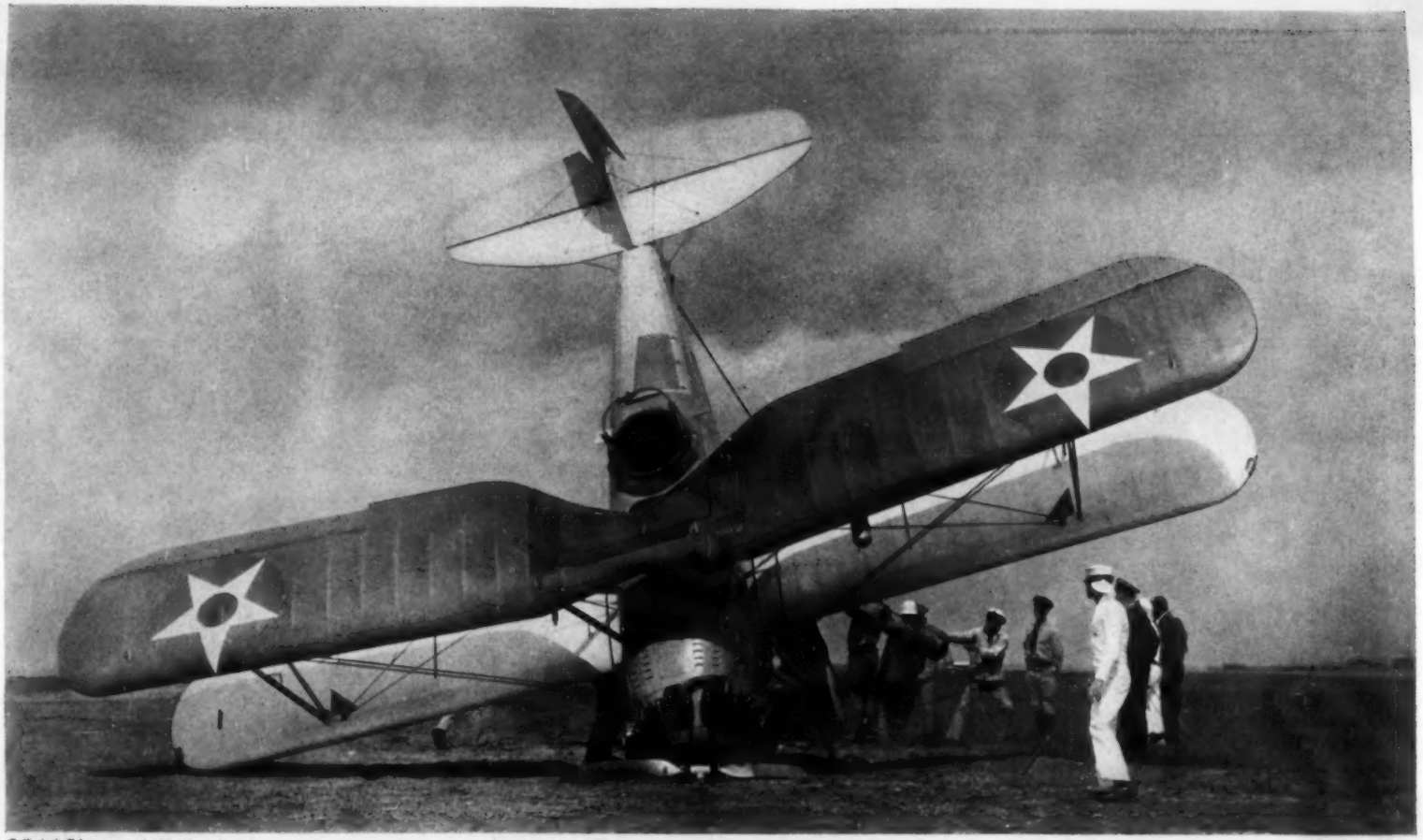
THE ELEMENTARY LANDING GEAR OF THE FIRST PLANE

Official Photograph U. S. Navy

A MODERN PLANE SHOWING LANDING GEAR

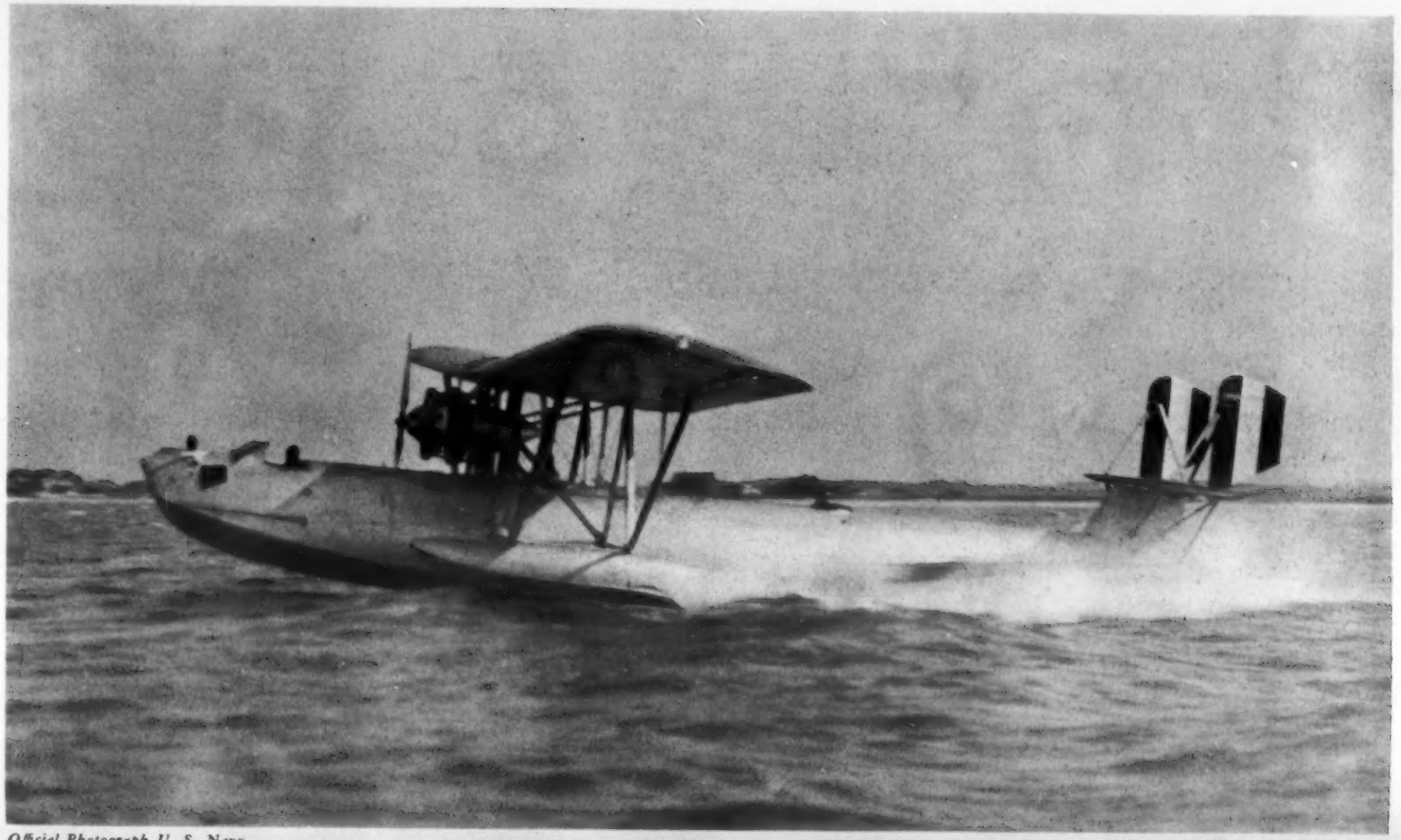
Official Photograph U. S. Navy

A MODERN PLANE SHOWING LANDING GEAR



Official Photograph U. S. Navy

ONE OF THE THIRTY-ONE PER CENT
(See article "Happy Landings.")

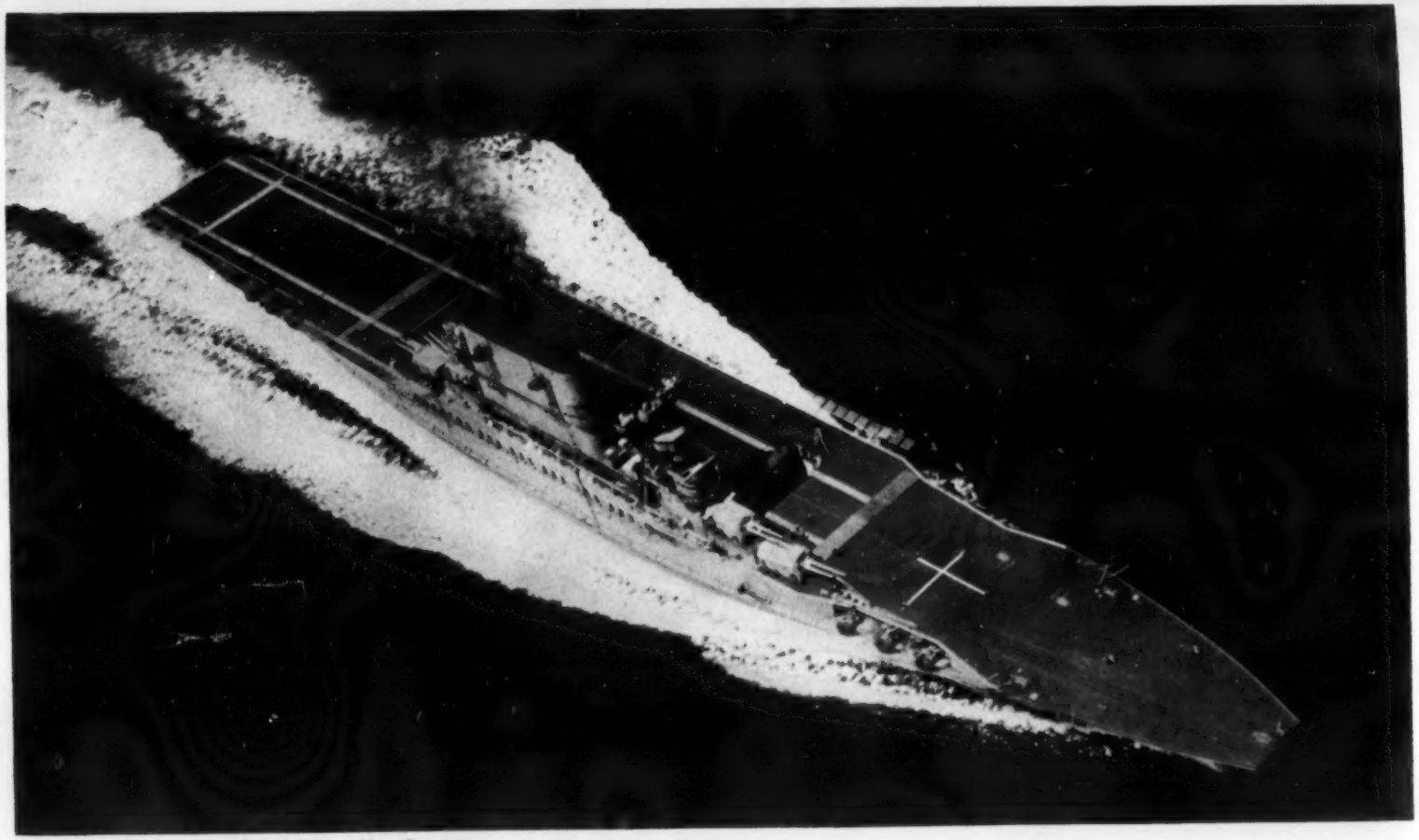


Official Photograph U. S. Navy

HAPPY LANDING!

Official Photograph U. S. Navy

HAPPY LANDING!



Courtesy Office of Naval Records and Library, Navy Department

U.S.S. *LEXINGTON*

Courtesy Lieutenant H. M. Martin, U. S. Navy

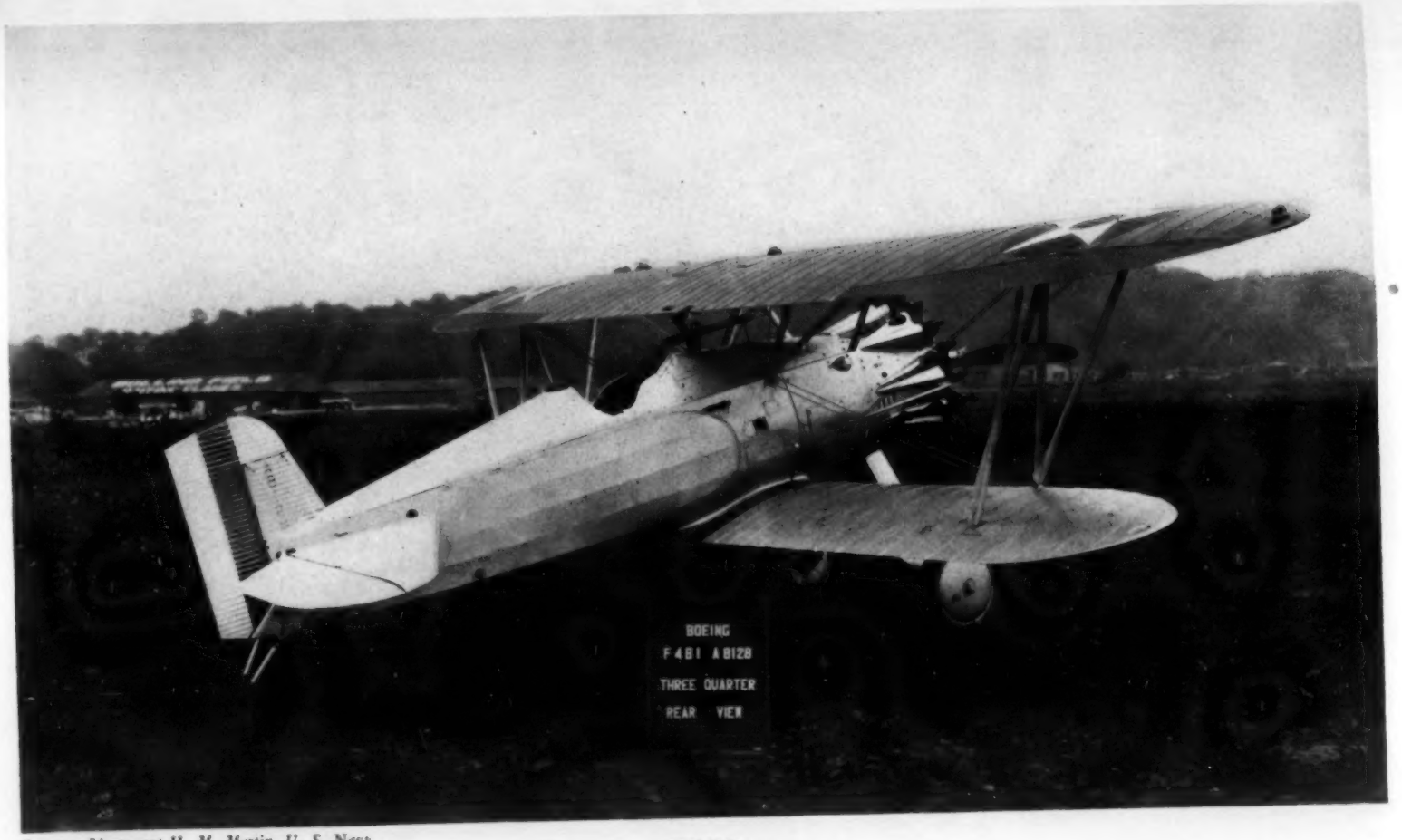
THE F3B

(This and the pictures immediately following refer to the article "Service Aircraft.")

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE F3B

(This and the pictures immediately following refer to the article "Service Aircraft.")



Courtesy Lieutenant H. M. Martin, U. S. Navy

THE F4B

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE F8C-4

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE F8C-4

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE O2U-4 LANDPLANE

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE O2U-4 AMPHIBIAN

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE O2U-4 AMPHIBIAN

Courtesy Lieutenant H. M. Martin, U. S. Navy

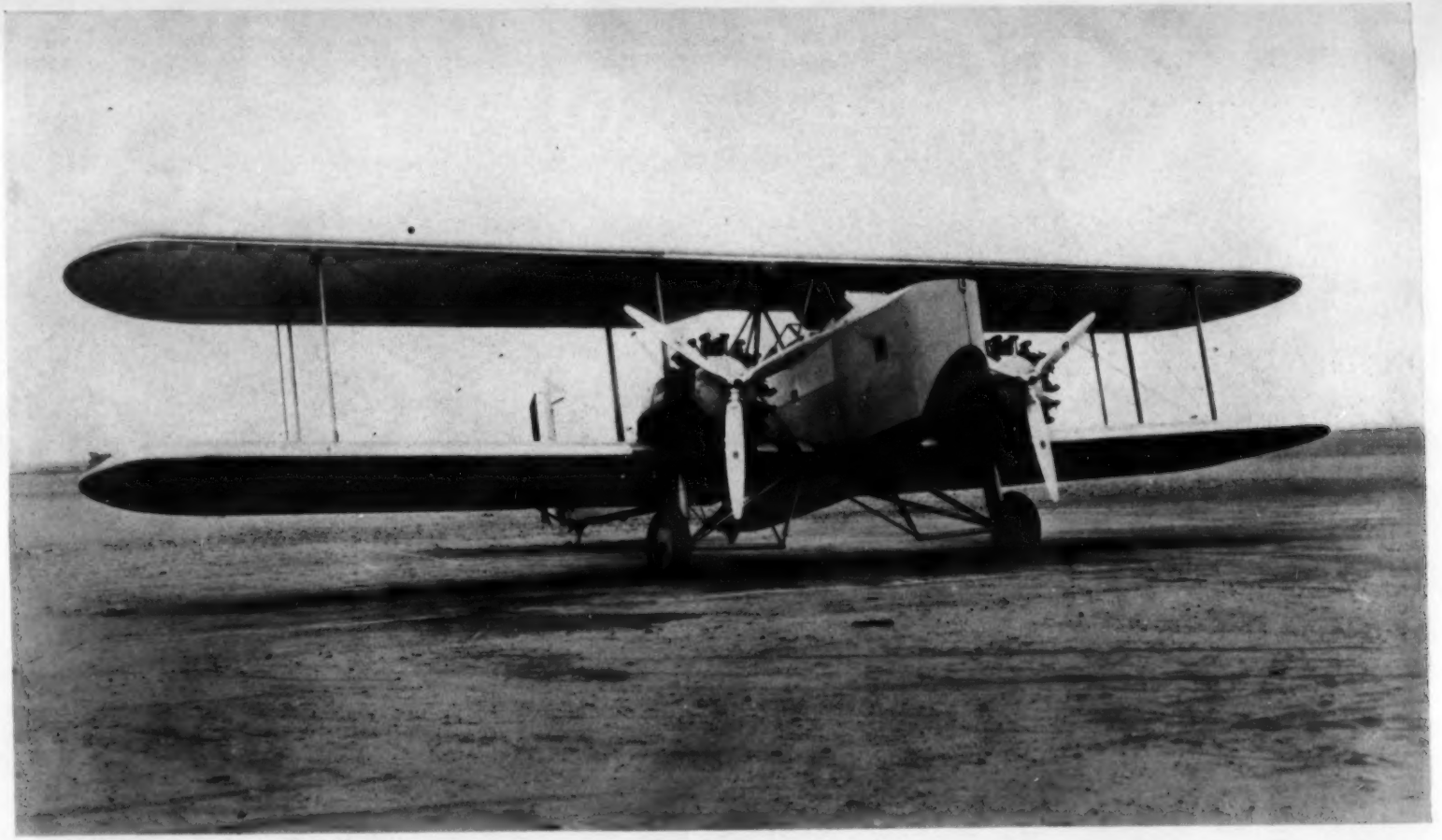
THE O3U-1

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE T4M-1

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE T4M-1



Courtesy Lieutenant H. M. Martin, U. S. Navy

THE T2D

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE PM-1

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE LOENING AMPHIBIAN

Courtesy Lieutenant H. M. Martin, U. S. Navy

THE SIKORSKY AMPHIBIAN

SERVICE AIRCRAFT

By Lieutenant Harold M. Martin, U. S. Navy

THE result of recent technical progress has been the production of numerous specialized types of ships, such as fleet submarines, large cruisers, mine layers, and aircraft carriers. There has been marked expansion of air activities. These developments have increased the demand for specialization on the part of the Navy's personnel. The size of the field covered by the Navy's material makes it impossible for officers to be experts in all the different branches. Consequently they are becoming specialized in the types of ships on which the exigencies of the service have permitted them to serve. Having become specialists in one particular field their specific knowledge of the rest of the Navy must suffer in comparison. Aviation, in particular, has become such a highly specialized branch of the service that very few officers outside of the actual flying personnel have had the opportunity to make intimate contact with the material and with the operating side of this arm.

This situation is unfortunate but, in the case of surface and subsurface ships, it will tend to remedy itself as the post-treaty Navy stabilizes itself and the new types become familiar components of the fleet. In aviation, however, the hope that familiarity will overcome this lack of knowledge is futile inasmuch as the standardization of aircraft is something that can be accomplished only in the far distant future. Even in the ranks of aviators the changes which take place between sea and shore cruises are so great that an officer returns to sea duty unfamiliar with numerous new types. This growth and change while bringing with it numerous operating difficulties is an excellent indication of the readiness of the Navy to appreciate and utilize the latest developments in the aviation industry.

The gravity of the situation cannot be appreciated unless its possibilities in war time are examined. The high speed and endurance of the modern airplane will permit its operation over a large area. The inadequacy of recognition signals or even distinctive formations will be apparent when it is realized that the noise of the approach is usually the first indication of the presence of aircraft. In normal circumstances carriers must operate close to the battle line and under the protection of surface types with the result that all aircraft must leave and return to their bases under the eyes of the whole fleet. Past experience in war time has shown the difficulty of operating submarines in the areas adjacent to the fleet without subjecting them to the constant danger of being fired on by friendly ships. This danger will be magnified many times in the case of aircraft when their spheres of activity and their numbers are considered.

It is to be expected that any method devised to prevent such occurrences will be, at its best, imperfect, but any steps which may lessen these dangers will be a substantial contribution to the morale and efficiency of the aircraft operating personnel. There exists considerable room for experiment in the field of coöperation between anti-aircraft batteries and planes. Some of the phases of this problem were explored during the late war but much remains to be done before the maximum can be achieved.

It is essential that some method be devised for familiarizing non-flying personnel with the distinctive features and outstanding characteristics of the planes which form the Navy's aircraft arm. With such knowledge, the identification of hostile aircraft will be simplified. This is particularly applicable to the officers and men of the anti-aircraft batteries. There are many new devices in the process of development which will assist in solving this problem of recognition. Satisfactory telephone sets will permit oral challenge. Developments in listening devices eventually will permit the identification of types by sound. Until these devices reach the standard of reliability where their efficiency is unquestioned the only alternative

THE SIKORSKY AMPHIBIAN

Courtesy Lieutenant H. M. Martin, U. S. Navy

is visual recognition. Since the latter method always will be the final arbiter under any condition, steps should be taken to make each officer and man familiar with the appearance of the Navy's airplanes. The crews of surface craft should be encouraged, or even obliged to visit and inspect fleet air bases and carriers under the guidance of an experienced aviator. The use of pictures and silhouettes accompanied by short lectures will amplify these inspections and impress on those outside of aviation the pertinent and distinctive features of the aircraft belonging to the Navy. The purpose of this article is to summarize, with the aid of photographs, a few of the details which may assist non-flying personnel to recognize the various types of aircraft assigned to the fleet.

VF or fighting planes.—This group of planes, having the primary mission of offensive operations against hostile aircraft or exposed personnel on surface craft, will be small, fast, and maneuverable. They will be armed with two machine guns and will carry at least four small demolition bombs. If necessary each can be armed with a 500-pound bomb thus becoming a weapon dangerous to the integrity of surface craft. Their normal fighting area will be higher than other aircraft, from which advantageous position they will be able to attack hostile aircraft and to deny to the enemy the use of the air adjacent to the fleet. With the addition of auxiliary tanks their flight endurance will approximate six hours thus making their operating area a circle whose radius is about 300 miles. Normally they will operate in 18-plane squadrons each, divided into two 9-plane divisions. Until recently the fighting plane in the Navy has been of the single-seater type, but considerable sentiment in favor of the two-seater fighter has been aroused. At the present time one VF squadron has been equipped with two-seater planes and experiments are being conducted as to the relative merits of the two types.

The standard fighting planes of the Navy are the F3B, the F4B, and the two-seater F8C-4. The F3B is a conventional biplane with small lower wings. Its sweepback in the top wing and its long regularly shaped fuselage ending in a small vertical stabilizer give it a peculiar silhouette which makes it easy to identify at practically any altitude. An additional distinctive feature is the unusual amount of stagger given to the lower wings. Its size might create some illusion as to its mission inasmuch as it exceeds in all dimensions the layman's idea of the fast single seater. Powered with the Wasp engine its most important performance data are as follows:

Speed range .....57 to 156 m.p.h.
Service ceiling .....24,800 ft.

The F4B corresponds more closely to the layman's idea as to how a single-seater fighter should look. Its short upper wing and its close coupled "humpbacked" fuselage give it the appearance of being much faster than its immediate predecessor, the F3B. A reduction of three feet in its upper wing span reduces the overhang since the lower wing is the same length as that of the F3B. Sweepback is also eliminated thus making the leading edges of the two wings parallel. The fact that it is smaller than any other service type leaves but little doubt as to its mission and its identification should be comparatively simple. The power plant of the F4B is also the Wasp 450-hp. radial engine. The reduction in size, weight, and better streamlining permits its performance to exceed that of its predecessors.

Speed range .....58 to 169 m.p.h.
Service ceiling .....26,900 ft.

The two-seater fighter has not yet established itself as a desirable unit of the carrier-based squadrons. Its usefulness as a defensive fighter is unquestioned but its size and the space it would occupy raise doubt as to whether the luxury of this type can be afforded on board ship. The advantages of the rear gun are numerous, but the weight involved causes an increase in size and a decrease in performance. The necessity of giving it a strength factor equal to the demands of violent maneuvers also causes an increase in weight which deprives it of many of its tactical advantages in its competition with the single seater.

This particular plane, the F8C-4, will often be confused with the Navy's other two seater, the O2U. At close range the marked sweepback and the large fuselage first attract attention. The shape of the rudder and the sunken rear cockpit also tend to distinguish it from the observation planes. The fact that the pilot and the gunner sit back to back will help to identify it when

seen in the air. Like all other VF-types the power plant is the 450-hp.Wasp.

Speed range .....56 to 145 m.p.h.
Service ceiling .....20,700 ft.

VO and VS.—The observation and scouting plane is probably the aircraft most familiar to the non-flying personnel. The presence of the O2U aboard battleships and cruisers has afforded the personnel of these vessels the opportunity to become acquainted with it. When operating from vessels other than carriers the fact that it will be a seaplane adds a distinctive characteristic to its appearance. Having once become familiar with the O2U and its successors the O2U-2, 3, and 4, little difficulty will be experienced in recognizing its prototype on wheels. Every effort is being exerted to design a satisfactory amphibian gear, thus giving it the ability to land on carriers for refueling.

These planes, when assigned to the observation wing, have the primary mission of spotting, with a possible secondary mission of tactical scouting. Little attempt is made to equip them with offensive armament but they are provided with a fixed and free machine gun for protective purposes. Their normal position in time of battle would be at the van and rear of the battle line, flying an elliptical spotting circuit for the control of gunfire. Normally they will be within visual contact of vessels of the battle line and, inasmuch as their location and formation will remain fixed, their recognition will not be difficult.

When these planes are assigned to the scouting squadron both on cruisers and carriers their primary mission will be strategical and tactical scouting. The cruiser planes will be seaplanes or amphibians; the carrier planes, landplanes or amphibians. Their operating areas will be at some distance from the main body of the fleet and thus out of visual contact with surface craft, except on their departure and return to base. As they are equipped with radio and are in constant communication with their bases their presence in certain areas can be forecast and their identity thus established. It will be essential that their appearance be familiar to anti-aircraft battery control officers as their approach will normally be from the direction of the enemy's main body.

The O2U and the O3U series are the logical development of the UO, the Navy's original observation plane. It is a conventional biplane with sweepback in the top wing, no overhang, and a large vertical stabilizer and rudder. Since it is a two-seater it is somewhat larger than the single-seater fighting plane. In accordance with the Navy's policy of standardizing the engine installation it is equipped with the Wasp 450-hp. radial engine which gives it the following performance as a seaplane:

Speed range .....59 to 145 m.p.h.
Service ceiling .....17,500 ft.

As a landplane the performance data are as follows:

Speed range .....60 to 147 m.p.h.
Service ceiling .....20,100 ft.

VT or torpedo planes.—This type of plane serves the dual purpose of a torpedo plane and a high-altitude bomber. Because of the limited storage space aboard carriers it is necessary to combine these two functions in one type of plane. They are the aëronautical contributions to the offensive weapons against surface ships or fortifications. In many respects their functions may be compared to those of the major caliber rifle and the torpedo tube. Their mission will always be offensive with surface craft or shore bases as the objectives of attack. Their equipment for aërial combat will consist of one or more machine guns for the purpose of defense. Ordinarily they will operate under the protection of fighting planes, but when grouped in a compact formation they offer each other a considerable protection, and constitute a very difficult target for hostile aircraft. With the improvement of anti-aircraft batteries it is becoming more essential that the element of surprise, speed, and high altitude be considered in their operations. Night operations by this type of plane are considered feasible and consequently provision must be incorporated in its design for flying at night.

When acting as torpedo planes some protection in the way of smoke screen and deck strafing must be provided to permit them to get within effective range. The number of ships over which they must pass and the low altitude of their approach make a successful torpedo attack on the main body a hazardous and difficult task. Provision is made in these planes for the installation of smoke-laying devices, and the use of chemicals as either a protective or offensive screen can be looked upon as a reliable and effi-

cient means of restricting the vision of the enemy.

The ideal bomber or torpedo plane would be twin engined with unobstructed vision for the bomber. Various planes of this type have been experimented with but the difficulty of operating them from carriers has restricted their use to the shore-based squadrons.

The standard torpedo and bombing plane in use by the aircraft squadrons at present is the T4M or TG, identical planes manufactured by different companies. It is a single-engined tractor biplane with thick, high-lift wings. Much larger than any of the other types in use on carriers, its identification is principally based on size. A large three-passenger fuselage gives it a heavy appearance which is accentuated by its widespread landing gear. The upper and lower wings are of the same dimensions thus giving it no overhang. The wings are not staggered and consequently form a box-like rectangle. The empennage is of standard design except that the balance of the rudder forms a break in the continuity of the vertical surfaces.

Provisions have been made for operating torpedo planes as seaplanes as well as landplanes. The landing gear when operating from the water consists of two large pontoons attached to the fuselage by heavy vertical and diagonal struts. While performance is reduced somewhat, this plane is very satisfactory as a seaplane.

All torpedo planes are equipped to carry radio and thus communication can be maintained with their base. This is important in that it permits the assignment of a mission to these planes while they are in the air or a change in their objective after the attack has been launched.

The power plant is the Hornet 525-hp. radial engine manufactured by Pratt and Whitney. Many of the parts of this engine are interchangeable with the Wasp thus reducing the number of spare parts and accessories required on board a carrier.

With the Hornet engine the T4M performance is as follows:

Speed range .....56 to 114 m.p.h.
Service ceiling .....10,150 ft.

The twin-engined torpedo and bombing planes are largely in an experimental stage but the torpedo squadrons at Coco Solo and Pearl Harbor have been assigned several of these planes for test. This type, the T2D, may be operated as a seaplane or landplane. Its twin engines and projecting fuselage are distinctive enough to need very little further description. Its exceptional performance makes it an extremely valuable plane, but the difficulty in synchronizing its twin engines and its large span make its usefulness on a carrier very doubtful. These planes will be encountered only when operating in the vicinity of the aforementioned bases so nothing more need be said as to their detailed appearance.

Their performance data are as follows:

Speed range .....56 to 124 m.p.h.
Service ceiling .....13,830 ft.

VP or patrol planes.—The history of this type of plane is largely the history of naval aviation. During the late war our flying was largely confined to patrol planes. Starting with the H.S. pusher, single-engined boat, we gradually developed the H-16 and the F5L with twin tractor engines and increased performance. For several years after the war practically all fleet coöperation and spotting was conducted in these flying boats. With the introduction of catapults and carriers these planes disappeared in the rush to develop the more modern types. It has been only during the last few years that time and money have permitted the further development of patrol planes. During this lapse several experimental flying boats were constructed, the most successful of which were the PN series which incorporated in metal construction most of the details of the wooden F5L. When the need for patrol squadrons became urgent the results of these experiments were utilized in the design of a service plane known as the PD-1. Later another series known as the PM-1 was started similar in every respect to the PD-1. The elimination of numerous struts and the improvement of the wing contour made possible shorter and more efficient wings. Additional facilities for the comfort of the personnel were provided making it possible for the crew to live aboard during long cruises. Advantage was taken of the development in aircraft engines, and Wright 525-hp. air-cooled radial engines were installed. With minor alterations and changes this plane has proved to be an excellent patrol boat having all the seaworthy qualities of the F5L and the increased performance which ten years of advance in design has afforded.

The purpose of this type of plane is, as its name signifies, off-shore patrol. Inherent characteristics of flying boats not only make it necessary that they base in comparatively sheltered areas but their long radii of action permit them to operate long distances from their base. With fuel for more than twelve hours and a cruising speed of 90 miles an hour they are capable of maintaining a scouting line 500 miles from their point of departure. For convoy work and antisubmarine patrol they will be extremely effective. As they are provided with bomb racks capable of carrying the heaviest of bombs they possess offensive qualities which will permit them to take part in offensive operations. Particularly at night will they be effective in bombing hostile ships. Patrol squadrons based on ships are capable of accompanying the fleet from base to base. On over-seas expeditions they will play an important part in the defense of advanced bases. Their defensive armament consists of four machine guns which become very effective in repelling aircraft attack when the plane is flying just off the water. Radio is installed thus permitting two-way communication between the planes and their bases.

These patrol planes are, in reality, flying boats with a large sponsoned hull to which is attached a set of biplane wings. The after part of the hull supports a set of control surfaces. Wing tip floats secured to the outboard ends of the lower wings provide lateral stability when the plane is on the water. Twin engines are mounted in nacelles supported by interplane struts. The pilot's and bomber's cockpits are located forward of the engines giving them unrestricted vision to the front. Performance varies considerably with the loading of the plane but is approximately as follows:

Speed range .....62 to 117 m.p.h.
Service ceiling .....8,500 ft.

For some time there has been considerable sentiment in favor of the monoplane type of patrol plane. The XPY was built as an experiment and proved so satisfactory that a contract was awarded for the construction of nine more to be known as the P3M. The P3M is to be issued to a service squadron for comparative tests with the PD and the PM. This plane is the first radical departure from the F5L type. Sponsons have been eliminated and the hull lengthened considerably. Twin rudders located on top of the horizontal stabilizer replaced the single large rudder thus improving the lateral control. The absence of a lower wing has made it necessary to install large outrigger floats for the purpose of providing lateral stability on the water. Twin Wasp geared engines mounted directly above the floats give the plane excellent performance.

Speed range .....56 to 118 m.p.h.
Service ceiling .....14,500 ft.

Various other types of planes will be observed as components of the aircraft squadrons, but their missions are so varied and their numbers so few that little attention need be given them in this article. Such planes as the Loening amphibian, the Sikorsky amphibian, and similar types will perform various tasks outside of the mission of the regular squadrons. In order that these activities may be coördinated the planes in question are grouped in a utility squadron known as VJ. Their duties will be that of carrying mail or transporting personnel and material. The planes composing these units change so rapidly that no attempt will be made to describe them. They are normally commercial types and have little in the way of offsensive or defensive armament.

The Navy's training planes are ordinarily, with the exception of the primary training planes, obsolescent types which progress has relegated to that mission. The activities of the training planes will be outside of the fleet radius of action, so their identification is not a matter of particular importance.

The descriptions of the appearance and characteristics of service aircraft as sketched in this article have been brief and no attempt has been made to describe in detail anything but that which might meet the eye of the non-flying personnel. It is hoped that this summary of types will be of some assistance to the layman in identifying the planes which come within the sphere of activities of the group of ships composing the fleet. It can be expected that, with the development of our aircraft squadrons up to the requirements of the treaty fleet, the changes in types will be somewhat less radical, so that, with a knowledge of the present types, the average officer can keep abreast of these changes as they occur.

DESTRUCTION OF S.M.S. "CORMORAN"

By COMMANDER OWEN BARTLETT, U. S. Navy (Retired)

THE first violent hostile act of the war between the United States and Germany probably was the destruction of the S.M.S. *Cormoran* by her own commander in Apra Harbor, Guam. To those actively participating, the epsiode loomed large in interest, and in tragedy, owing chiefly to the unique situation which, over a long period of time, had permitted the friendly intercourse between the personnel of the ship and the colony ashore. In a large community, this friendly interest between the ship's company of an interned vessel and the authorities of the neutral nation could not have been feasible; but in Guam, no one could get away, and the addition of cultured foreign officers was a distinct boon to the small group that formed the local society. A number of the German officers and several of the chief petty officers lived ashore. Moreover the enlisted men were granted regular liberty, more or less restricted to certain localities.

S.M.S. *Cormoran* that figures in this yarn had originally been a Russian liner, captured by the German gunboat of that name. The gunboat had been cruising the South Seas when war broke in 1914. She picked up the officers and crew of a German survey and scientific ship; scuttled the ship; captured the Russian; and took the latter into Tsingtao, where she was reconditioned along with the *Emden, Prinz Eitel Freidrich* and others, and, as the "new" S.M.S. *Cormoran,* started out on a career of commerce destruction. Luck was not with her and she ran short of coal.

Her captain took her into a hidden harbor, known to him and a few other white men, in the South Sea, and sent three officers in a small boat to Guam to dicker for coal, or, failing that, to send a cable to the German ambassador in Washington, asking assistance in the matter of fuel. How the personnel of the ship subsisted on coconuts and fish, manufactured soap, and even brewed beer was told afterward. The small boat, after a trip of some 600 miles, reached Guam safely, and was promptly interned. No cable was sent to the German ambassador. The *Cormoran,* having waited more than sufficient time for the return of her emissaries, set sail for Guam, using coconut husks for fuel, and slipped into Apra Harbor while a Japanese cruiser was patrolling the other side of the island. The ship was not allowed to leave.

Then began negotiations covering internment, which much later—1916—were radically modified. The events leading up to these modifications and the startling denouement constitute another yarn that many naval men know. However, as a result of the latter negotiations between the captain of the *Cormoran* and the acting military governor of Guam, the ammunition, the breech plugs, sights, etc., of the 4.7-inch guns, and the small-arm ammunition and small arms were removed from the ship.

Moreover, and this constituted the key to her retention as an interned vessel, she was to be allowed coal enough for her to ride out a typhoon and return to Guam, as Apra Harbor is sometimes so storm swept that ships must put to sea. The very limited coal allowance was a more potent thing for successful internment than the small guns of the station ship *Supply,* which was often absent; or the half dozen old 6-inch guns mounted on hill tops, which still bore the Portuguese label of the Brazilian ship purchased by the United States in 1898, from which they were taken.

Watching the amount of coal supplied for port use and the monthly certificates of the captain as to the coal on board, together with judicious disposition of the 3-inch guns of the marines, appeared to guarantee the continued presence of the *Cormoran* in Guam, notwithstanding the fact that there were aboard some 350 well-trained men ready for any desperate sally against the meager and much scattered force of the governor should the "Guamitis" drive them suddenly crazy.

Later, it was bruited about that a number

of schemes had been considered by the personnel of the *Cormoran*—such as a landing and destruction of the cable station, followed by other eventualities which well-led men might have effected. The high power radio had not been commissioned. The cable was the only link with outside help, should occasion demand such a call. It is probable that the international situation that would have been created by such a move served as the deciding restraint to men whose confinement must have been bitterly irksome, and to whom news of the German-United States relations came in garbled, often distorted, snatches.

Reaching Guam in Christmas week, 1916, to take over the duties of aid to the governor, one of the first social functions that I attended was the wedding of a U. S. Navy nurse and a "temporary" officer of the *Cormoran*, who previously had been a German civil official in New Guinea—the ceremony being performed in the home of a medical officer in our service. During the ensuing month of January, a number of dances, dinners, beach parties were held. Many of the ship's officers were in attendance but, in deference to their countrymen on the fighting fronts, did not dance. The captain reciprocated by giving small dinners in his bungalow at Agana; but the breakdown of peace proposals during this month very evidently affected his previous assumption of gayety, and he spent more and more time on his ship.

At the beginning of February, however, invitations for a dinner on board were received by many officers and their families. We were told that a Japanese schooner had just brought supplies, long expected from the north, else the dinner would have been given earlier. It was the first affair on the *Cormoran* for some time and the feminine interest was naturally great—much speculation going on during the next few days about what to wear, etc., etc.—all as a normal accompaniment to any event of local interest in a very isolated community.

In the forenoon of the day of this social event, the governor received from Washington a much garbled dispatch—somehow the important ones were always garbled—which was eventually deciphered as instructions to assure himself that the interned vessel could not violate her internment by departure. Something was in the wind. In Washington —the date was February 3, 1917—diplomatic relations with Germany were broken that day, but we did not know it.

"Coal on hand," was the key to the *Cormoran's* detention. During the period of many months there might have been built up a reserve supply that did not appear in the reports of the commanding officer. The governor wrote a polite note to the captain requesting that an inspection of the coal on board be allowed his representative.

Arriving on board, I was received with the usual courtesy, and greeted by the captain in his commodious cabin with cordial friendliness. He was a large, well-formed man, with jet black mustache and Vandyke, always spotlessly attired, spoke English with the elegantness of the educated foreigner, was a gifted conversationalist, possessed a rare charm of manner, and, incidentally, must have been an able disciplinarian to have maintained the high morale evident in his personnel during their long sojourn in Guam.

When he had read the governor's note the man froze; his swarthy cheeks went white beneath the beard. After a few moments he told me that he could not comply with the governor's request, basing his refusal on his extraterritorial rights, and returned a polite but firm message to the governor, declining permission to allow the inspection of his coal supply. It was well past noon when I reached Agana, and orally delivered the answer.

When this was received by the governor, he quietly dictated an *order* from the "military commander of Guam" to the captain of the *Cormoran* demanding that the latter permit the inspection. Also, the colonel of marines was directed to muster his force at Piti immediately, and all small craft were assembled there preparatory to enforcing if need be the governor's demand. Things were getting tense. And this all took time.

With oral instructions to confer with the colonel of marines as to procedure in the event that force became necessary, with the order in my pocket, and accompanied by Lieutenant E. B. Woodworth, U.S.N., and a civilian engineer, "armed" with a steel tape measure for making accurate estimate of the coal, we drove to Piti.

The marines had assembled, several field guns were being loaded on flat barges, all the craft were ready to tow the force out

to the harbor—which is blanketed from Piti by high land. While conferring with the colonel of marines as to signals, methods of boarding, and procedure after boarding it was hard to realize that this was not some sort of a play we were rehearshing. To suddenly plunge from the pleasant anticipation of a friendly dinner on a friendly ship to cold-blooded plans for boarding that ship and offering one's would-be hosts cold steel as a cocktail, savored too much of *opéra-bouffe* to be real!

Leaving the force completing its preparations, we went out to the *Cormoran*. This time, all cordiality had faded from the reception. The captain stood in the middle of his cabin, read the governor's demand, and said that he did not see that the wording of this message altered the situation; that he desired to send a cable to the German ambassador in Washington, stating the conditions and requesting instructions. He handed me this cable written in English; and again firmly declined to allow the inspection until he had received instructions.

Returning to Piti, where all was in readiness, I telephoned the governor the result of this interview. He hesitated a few moments, and then his quiet voice came over the phone:

"Very well, Bartlett! Confer with Colonel Berkeley. Go out and take the ship."

The next few minutes of telephone conversation were desperately earnest, in which it was urged that a show of force and determination probably would accomplish the desired result without the bloodshed that would certainly accompany a boarding operation. In the end the governor yielded, but he enjoined haste:

"Hurry, it is getting late, and the inspection must be made before dark!"

We hurried. The embarked force moved out toward the harbor. Should our fast mahogany motor barge be seen returning toward Piti a few minutes after making the *Cormoran*, the force was to come on. If the boat remained alongside, the force was to remain in the offing. The latter would indicate that the inspection was progressing.

The third trip to the *Cormoran* met with a very different reception. The captain had evidently decided to yield. In an attitude of resignation, he accepted the reiterated demand, made orally this time, but insisted that he have some written evidence to prove that he stood on his so-called "extraterritorial" rights, and that he yielded only in the face of conditions that he could not control. Accordingly, at his dictation, I wrote such a document, setting forth the brief facts, took a copy of it, and we each signed both.

Thereafter, geniality somewhat returned. Everything possible was done to facilitate the inspection. The chief engineer brought in his reports and sketches of the bunkers, which we examined. The main bunker was shown to be a huge compartment in the bottom of the ship extending entirely across athwartships.

A couple of months later, we learned what an important part this bunker was playing and was to play in the events about which this yarn is being spun. As a matter of fact, all the tenseness of the day might have been avoided had this particular hold been innocently ready for the prying eyes of representatives of the neutral nation that was holding the *Cormoran* interned when those representatives first requested permission to inspect!

After looking over the papers that the chief engineer presented, we proceeded with the inspection; entered the big bunker, through great hatches from which the hatch covers were with *apparent difficulty* removed, took the dimensions of the compartment, measured the coal, after having the ship's bottom uncovered in two corners, and finally estimated the amount of coal in the ready bunkers near the boilers. It all tallied within the few tons that a careful engineer always allows himself on the safe side.

As we stood watching the hatches being secured, it occurred to me with a touch of irony that the hour for dinner was almost at hand, and I made some frivolous remark to the captain about my regret that the events of the day would prevent my sampling of those "sea stores" that had recently come from the north. He turned to me instantly and said: "But of course you are to come to dinner! You have unpleasant duties to perform; I have unpleasant duties to perform; but this need make no difference in personal relationship. We shall expect you for dinner when it is convenient for you to return."

As we begrimed ones returned to Piti, not much was said except that it was agreed that "mum's the word."

The anticlimax was too much. We very much needed baths. We also needed pre-Volstead stimulant. The boarding force had had more than an inkling that they were not needed, and looked on us as persons who had somehow spoiled a lovely party. Also they were hungry. They went home disappointed while the telephone report was being made to the governor.

Half an hour later a couple of Fords conveying bright, laughing women in evening dress arrived in Piti, and, without an apparent care in the world, or a spoken hint or question of the day's happenings, embarked in the motor barge for the belated dinner.

It was a beautiful affair. The gangway was decked with bunting, and, as we reached the deck, the white-clad officers met us with all the old-time courtesy of low bows and cordial greetings. The captain was more than punctilious; he was the perfect host personified, and we strolled forward to his cabin under and through a bower of flowers, ferns, and brilliant tropical tree blossoms. The safe arrival of the "sea stores" from the north was evidenced in welcome and generous cocktails: The time honored, "So glad to see you aboard, sir!" "So glad to be aboard, sir, and your very good health!"

Then we went out to the port side of the long, broad deck and were seated at a table bowered in greens and tree flowers—shaded lights, well-appointed table, excellent food, the gleaming white uniforms of the officers and light dresses of the ladies contrasting against the black forms of the New Guinea messmen in the shadows, the warm tropic night with low hung moon and stars in a velvet sky, and round the table, laughter, banter, with not a hint of tenseness.

Later we returned to the cabin and were shown many trophies of the cruises in the South Seas, each with its anecdote; the ladies and some of the officers played and sang an opera score, written and composed on board; an officer artist exhibited a group of his paintings of scenes in Guam.

Knowing, as he must have known, that the afternoon's events portended others, the eyes of this interned German captain were deep, black caverns of suppressed emotion, but never for a moment was he other than the perfect host. As we left, he pointed to a fine collection of Polynesian spears and arrows and remarked with a sad smile: "Those are the only implements of war that we have on board, Bartlett." The sole sentence that could be interpreted as reference to the earlier events of the day.

The memory of the evening ends with the mental picture of our hosts standing at the rail, bidding us *au revoir*, and a moment later waving good-bye as the barge gathered way, carrying us across the moonlit, phosphorescent water.

That night the coded cable came announcing that diplomatic relations with Germany had been broken.

All the officers and enlisted personnel of the *Cormoran* were notified to return to their vessel. Within twenty-four hours all communication with the ship was severed except for the supply of provisions and the necessary official correspondence; outlying stations commanding the harbor had been occupied with men, searchlights, and field guns; a perpetual patrol of the harbor had been instituted, and plans laid for eventualities. German resourcefulness and ingenuity were not underestimated. It was realized that the "sea stores" which periodically came from the north in small Japanese trading schooners might, in the past, have been innocently labeled, and yet have contained substances more potent than beer. Moreover it would not have been much of a trick to have machined plugs that would serve in the breeches of the guns. It paid to take no chances.

Under the provisions of international law the personnel of an interned vessel may be removed to a "fortress." There was no fortress nor any other place in Guam where the personnel, in their status of interned persons, could be fittingly housed. Their own ship was the only available solution. It was recognized that, should war become an established fact, the Germans might attempt a desperate sally against the vulnerable cable station near by, and would certainly attempt to sink their vessel. Unfortunately, the water in Apra Harbor is either reef shoals or twenty fathoms and more deep. Short of beaching the craft, there was no place to moor her, where if sunk, she might be salvaged. The only hope of salvage lay in perfecting arrangements for boarding, severing the moorings by explosive after attempting to close the sea valves, and beaching *after* a demand for surrender had been refused and before the ship flooded.

During the following weeks many con-

ferences were held by the governor; every resource of the island considered and fitted into the part it was to play, and minute plans were drawn up for saving the ship. Needless to say, the war orders were kept up to the minute, and needed but the stamping of the date and the sounding of the agreed signal to put machinery in motion.

Guam is east of the 180th meridian, about nine hours and twenty minutes toward the setting sun from Washington and therefore the date in Guam for many hours of the twenty-four is one day in advance. For instance, when people in Washington are lunching at 1:30 P.M., of any day, the natives of Guam are stirring restlessly before the dawn of the following day.

That particular hour of 1:30 P.M., on April 6, 1917, witnessed the signing of an epoch-making document in the White House. In Guam, on the other side of the world, almost simultaneously, a short, coded "flash" on the cable came to the "Governor and Military Commander," Captain Roy C. Smith, U. S. Navy—a "flash" that meant war.

A telephone tinkled once in my room. The unmistakable voice came quietly over the phone: "Please come to the office, Bartlett." I knew.

As the brief reports came in from the various stations that orders had been received, the official car, a Ford touring with the coat of arms of the United States emblazoned proudly on its panels, drew up outside. Lieutenant W. F. Lafrenz, U. S. Navy, who was to accompany me to the harbor, joined, and then the governor handed me three papers.

Since I believe that they are unique as being the only documents of similar nature used during our participation in the war, they are quoted verbatim:

NAVAL GOVERNMENT OF GUAM
GOVERNMENT HOUSE, GUAM, April 7, 1917.

From: Governor and Military Commander of Guam

To: Senior Naval Aid

Subject: Orders re surrender of S.M.S. *Cormoran*.

1. War exists between the United States and Germany.

2. Proceed to the *Cormoran* under a flag of truce. Inform her Commanding Officer of the fact stated in par. 1 hereof, and demand that he surrender his command to you as my representative.

3. In case of his compliance arrange with him specific terms of surrender following the provisions of the Laws of War as accepted by the United States and take duplicate copies of the agreement. Arrange for immediate transfer of all armament.

4. In case of surrender, arrange to turn over the prisoners of war to the commander of the Shore Force and to turn over the surrendered ship to the commander of Harbor Patrol, who will detail a prize master and prize crew to take charge of the ship.

5. In case of refusal to comply with your demands inform the Commanding Officer that he and his command will be treated as an enemy.

ROY C. SMITH

NAVAL GOVERNMENT OF GUAM
GOVERNMENT HOUSE, GUAM, April 7, 1917.

SIR:

This letter will be presented by Lieutenant Owen Bartlett, U.S.N., Senior Naval Aid.

War now exists between the United States of America and the German Empire.

Lieutenant Bartlett is empowered to receive the immediate and unconditional surrender of the ship and personnel under your command.

The Rules of Military Honor will be observed.

Lieutenant Bartlett is likewise empowered to sign the agreement of capitulation.

Respectfully,

ROY C. SMITH
Governor and Military Commander of Guam

Commanding Officer
S.M.S. *Cormoran*,
Apra Harbor.

NAVAL GOVERNMENT OF GUAM
GOVERNMENT HOUSE, GUAM, April 7, 1917.

Capitulation of S.M.S. Cormoran, 1917

The following agreement of capitulation has been concluded between the Governor and Military Commander of Guam through his duly authorized representative and the Commanding Officer of S.M.S. *Cormoran*, both acting with full powers from the President of the United States of America and the Emperor of the German Empire;

Art. I. The personnel of S.M.S. *Cormoran* become prisoners of war.

Art. II. Arms and all public property will be turned over to duly authorized representatives. Officers may retain their swords and private baggage. The clothing and other private property necessary for the comfort of the crew may be retained. The United States Government will assume no responsibility for private property of officers and crew.

Art. III. On arrival of transportation the crew of S.M.S. *Cormoran* will evacuate the vessel. At the same time the prize master with prize crew will take possession.

Art. IV. All other details will be in conformity with the Rules of War.

The governor shook hands, wished me luck, and we were off on the lovely 5-mile drive along the shore and through coconut

palms to the port of Piti. All was ready there—the prize crew under Lieutenant W. A. Hall, U.S.N., standing by; the governor's fast, sleek mahogany barge with white flag of truce snapping at the bow, new ensign at the staff, engines purring; two quartermasters with flags to be used in the event of surrender; and the native crew of the barge at their stations. As the barge left the dock at Piti, at 7:40 A.M., the great steam whistle back in Agana blew its five long blasts announcing to all that war was a fact.

As we rounded the point of Cabras Island and opened up the harbor ahead, the *Cormoran* loomed large and alone at her moorings, for the collier *Proteus* and the tug *Piscataqua* were well out to sea, and the station ship, U.S.S. *Supply*, off the harbor entrance. By contrast, the small motor boat of the *Cormoran*, in charge of the officer who had married the Navy nurse, was standing in to the boat channel for stores. Poor chap, his honeymoon had been a short one, and so he was the officer habitually detailed from the *Cormoran* to come to the dock for stores and, incidentally, with an official chaperon listening in, hold converse with his bride for a few minutes.

We noticed that the German ensign was flying on the *Cormoran*. This circumstance gave rise to considerable speculation later, for it had been agreed that, in the event of surrender, the German ensign, if flying, would be hauled down and the United States ensign substituted. Now, it is the naval custom, when a ship is at anchor, to hoist the colors with considerable ceremony at a set hour in the morning, generally 8:00 A.M. Moreover, if other men-o'-war in sight are under way after daylight before that hour, as were our ships, the colors are also hoisted —as was done on the German ship this morning—but are lowered a minute before 8:00 A.M., and run up again at 8:00, with all hands facing the colors at attention and salute. As it happened, watchers ashore saw the barge make the ship; a minute or two later, saw the colors dipped at 7:59 A.M., and surmised that she had surrendered. They were astonished sixty seconds later to see them again appear at the staff.

Evidently our errand had been understood as we approached, for the partial "field day" (weekly scouring and furbishing) was interrupted and on the ship there was general scurrying about.

When I reached the deck, however, about 7:57 A.M., the long broad starboard gangway that in other days had been a passenger promenade was deserted, and the officer of the deck only was there at the head of the ladder, standing in rigid military attitude, to greet me.

Requesting permission to speak to the commanding officer, I was escorted forward along this promenade to the captain's cabin. Entering the cabin I faced the captain, Korvetten-kapitan Zuckschwerdt; the executive officer, Kapitan-leutnant Coulmann, who were standing together, and was followed into the cabin by the aid, Oberleut zur See Mueller. From the corner of my eye, I saw that all the ports framed blond, bearded German faces of the crew, with more faces beyond.

I addressed the captain, this man who at our last meeting had been my social host, this man who seemed to have shrunk, to have visibly greyed, to have aged many years: "I have a letter to present to you, sir," and handed him the demand for surrender quoted above.

He read it slowly, and without comment handed it to the executive officer, who also slowly read it, and who in turn handed it to Oberleutnant Mueller, who took in the import at a glance and returned the paper to the captain.

The latter, holding this innocent appearing document in his hand, braced back his shoulders and said to me: "Have you another officer with you to hear my reply?"

I answered, "There is an officer in the barge, which is lying off, but it will not be necessary to have him present to hear your reply."

The captain then stepped past me to the door of his cabin and closed it. As the door shut, a guttural, throaty yell of exultation, *"Cormoran! Cormoran!"* went up on the deck outside, the faces disappeared from the ports, there was the quick thud, thud of many feet running, mingled with shouts and cheers.

Standing near the door of the cabin, the captain, very erect now, chose his words deliberately and carefully: "In reply to this letter, I state that this is an unarmed and defenseless ship, incapable of resistance. I am willing to turn over the officers and crew of the *Cormoran* to your charge, but I cannot turn over the ship!"

I answered: "I am not authorized, sir, to discuss terms other than as stated in the letter just presented to you. I am here to accept the 'immediate unconditional surrender' of the officers, the crew, and the vessel under your command."

Standing rigidly at his full height, with eyes blazing and boring into mine he reiterated: "In reply, I repeat that I am willing to turn over to your charge the officers and crew of the *Cormoran,* but I cannot and will not surrender the ship!"

It was strangely quiet in the cabin there. The pandemonium outside the ports had faded to a distance. In all that ship's company, only these three were near, the captain standing a little apart from his fellows, facing the representative of that nation which was now an enemy, that nation whose guns would quickly speak when the flag of truce returned.

"Then I have to inform you, sir, that, when your answer is received, you will be treated as an enemy, and your vessel as an enemy vessel."

"Is this final?"

"It is final."

"You have my answer."

Saluting, I started toward the door, which Mueller opened, and leaving them there in the cabin, crossed in the athwartship passage to the starboard side and stepped on deck. 'Way aft, the crew were shouting and singing, a band was playing, cries of *"Cormoran! Cormoran!"* came distinct from the jumble of sounds.

The officer of the deck saluted without a word in answer to my salute and customary: "With your permission, I am leaving the ship, sir."

The sight from the ladder was not reassuring. Astern were many Germans in the water; others were jumping; boxes, suitcases, life-preservers, etc., were spewing overside in a shower—and in the midst of it, lying off the quarter near by, was the barge.

The craft leaped ahead as the coxswain sighted me. On the ship, cheers rang out—three great cheers—*"Cormoran! Cormoran! Cormoran!"* Jumping as the barge came by, I left the ship.

Lafrenz, who had seen the colors lowered at 7:59, but had not seen them raised again at 8:00, greeted me with: "I thought you were going to stay aboard if she surrendered." His face was a picture of amazement when he heard, "She did not surrender."

We had gone toward Piti at full speed perhaps a hundred yards and were just well clear of the bow, when there came the dull heavy shock of muffled under-water explosion. Red flames with little smoke shot up around the bridge of the *Cormoran;* pieces of débris rose, arched, fell; the bridge and region of the captain's cabin popped up, crumpled, collapsed.

The stricken ship settled by the stern, slowly listing heavily to starboard. For a moment the port half of the deck was exposed to view, the ship lying almost horizontally on her starboard beam ends. Then, as one blinked an eye there was nothing but a small column of water hanging suspended, a bubbling seething area of surface disturbance, a bit of flotsam shooting up like a fish jumping and falling back with a splash, two or three laden boats, and heads, hundreds of heads, bobbing here and there.

It was said by those who watched, that the barge was alongside three minutes; that the interval between the explosion and the disappearance of the ship, four.

There is little more. The boats and floats that had been manned to receive the surrendered crew were quickly brought to the scene and began the work of rescue.

Men clinging to bits of wreckage, oars, life preservers, chests, were swimming toward the shore in all directions; pigeons, apparently carriers released from the ship, hovered over the water, circled, and were gone; men clinging to bits of flotsam with one arm, put bottles to their lips and drank from brown bottles, square colorless bottles; the black men of New Guinea, some carrying bundles dry on their heads, some pushing small chests, paddled off businesslike toward the nearest land. And then a voice was lifted, a strong true deep voice singing *Deutchland über alles,* and the chorus went up from many a throat.

Men who were strongly swimming waved approaching rescue boats on to less fortunate shipmates, who were making heavy weather of it. Manhood was there, and the best traditions of the sea.

Eventually, all but five were picked up, and the bodies of these were later recovered. Two others died that morning, one from heart failure, and one from the effects of a blow of a box thrown from the *Cormoran.*

These seven men were buried in the naval cemetery at Agana with full military honors, and a cement monument designed and made by the Germans marks their graves.

The rescued Germans, now "prisoners of war," numbering about 350, were taken to the dock at Piti, and turned over to the custody of the marines.

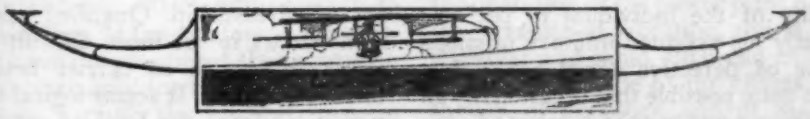
At this time an incident occurred which seems worth recording. The captain of the *Cormoran* had been picked up by his own power boat after he had jumped overboard from the ship. He, with a couple of his officers, and the men that they had rescued, was asked to proceed from the harbor to the dock under their own power, and no guard was put in the boat. Though I cannot vouch for the story from personal observation, I was told by eyewitnesses that, as the boat came alongside of the dock, the captain ordered the engine demolished. The engineer seized a large sledge and thoroughly smashed the engine. A marine sentry seeing the pantomime, and sizing up the situation, snapped his gun to his shoulder, sighted on the engineer, but, as he fired, the muzzle of the gun was thrown up violently by a marine officer who stood near, and the shot went harmlessly overhead.

The German enlisted personnel were placed in a prison camp, hastily thrown up, and the officers segregated in permanent hutments of a marine camp. Clothes were provided, and the wants of the prisoners of war tended with meticulous care—even to the matter of pay as prescribed for persons in similar circumstances. Three weeks later an Army transport took these men to the United States.

There is a story told of a German officer who had left Guam a week or so before the destruction of the *Cormoran*, and who heard in Manila that she had gone down. He mildly asked if the "American officer who demanded the surrender *had been permitted* to leave the ship!" Another story was that this very point had been discussed, and it had been decided on the *Cormoran* that, should a certain German officer have the deck when the American officer started to leave, he would be allowed to do so; but the other three deck officers had contrary opinions. As it happened, I left a minute after my friend took the deck and I was out there under a flag of truce. All slander, probably, for I witnessed nothing but the eminently chivalrous conduct which is the heritage of the naval officers of nations. Before they started the submarine frightfulness, the Germans lived up to the best traditions of the sea.

The point of my long prelude is that before the Germans departed, it was learned that when the inspection party went out two months before and asked permission to make an inspection of the bunkers of the ship, there was, in the big bunker, and the captain was most painfully aware of the fact—a huge demolition bomb, carried for the very purpose for which it was used on this eventful morning of April 7, 1917. He was compelled to dissemble the bomb, to delay until it and all traces of its installation had been removed, before the inspection proceeded.

I believe that, incident to this initial war episode of violence, the seven Germans who died were the first to succumb; those rescued were the first to become "prisoners of war;" and that the one shot was the first shot fired at an enemy German in the conflict between the United States and the German Empire.



A NEGLECTED PHASE OF NAVAL AVIATION

By Lieutenant Logan C. Ramsey, U. S. Navy

IF A naval aviator is to be of real military value he must be thoroughly competent in three phases of his specialty. Obviously the first of these requirements is that his airmanship be of high quality. He must be able to perform the most difficult of aërial maneuvers with the effortless ease of an expert. Logically, the second requisite is that he be able to leave a carrier or a shore base in his plane and proceed directly and unerringly to the vicinity of his objective. In other words he must be a thoroughly competent aërial navigator. Then, after locating his enemy, he must be able to accomplish the different forms of aërial attack or observation. A deficiency in any of these essentials reduces his over-all military value to a degree where it is questionable whether he can be classified as an asset or a liability.

The necessity for naval aviators being competent airmen is unquestioned. This is so well recognized that the standard to which the student aviator must conform during the training course at Pensacola is probably not exceeded anywhere in the world. It appears safe to assume that this necessity is receiving adequate attention. Even granting that a few individuals whose substandard airmanship is not brought to light by the rigid standards of instruction and check flights at Pensacola, they later either perfect themselves or are in time eliminated. Their names will disappear from the *Navy Register*, the final appearances being under the caption of "Deaths, Active." Hence, we may assume that our naval aviators are very competent in their airmanship.

No such wholesale and thorough elimination occurs during times of peace because of the inability of the individual to perform satisfactorily his assigned military missions or because of defective aërial navigation. While it is quite possible that occasionally an individual may come to grief because of poor navigation or clumsy handling of aërial weapons, it is also possible for the aviator deficient in either or both of these phases to continue as a part of the aëronautical organization of the Navy indefinitely, if not permanently. Such accidents from these causes as do occur are rarely accompanied by fatalities such as are those caused by faulty airmanship. Deficiencies in these two branches of aviation must be overcome by training, practice, and observation of the individuals concerned. Naturally, in time of war the poor aërial navigator and the poor aërial gunner are subjected by enemy action to much the same drastic elimination as is the subnormal airman during peace time.

If it is conceded that, at present, there is the possibility of some naval aviators being or becoming deficient in the performance of aërial military missions and in the art of aërial navigation, a discussion of the time and methods involved is in order.

We find that the latest report regarding handling of aërial weapons shows that, in the analysis of flight operations, each naval flier averaged during 1928-29 approximately thirty-three hours in the air on bombing, gunnery, and torpedo missions. When the number of pilots on shore duty, administrative missions afloat, etc.—in short the number of pilots not attached to active operating squadrons, is considered, this average does not seem a low one. It is probably safe to assume that the pilots attached to these squadrons performed an average of not less than one hundred flying hours during the year for these three purposes alone. The figures appear even more impressive when we consider the percentage of total flying time for the naval service (exclusive of training time) devoted to these three functions. Flying time devoted to training is essentially devoted to the perfection of the student in the art of airmanship. Qualified pilots spend many hours in the more difficult phases of airmanship, such as carrier landings and formation flying. It seems logical to exclude such time from the total of service flying. Hence with this elimination the time devoted to bombing, gunnery, and torpedo missions was approximately 22 per cent of flying hours accomplished. From the foregoing fig-

ures and from the known fact that the competition between aircraft squadrons for their gunnery trophy is very keen, it appears quite safe to state that entirely adequate efforts are being made to eliminate any deficiencies of the individual in the handling of aërial weapons and to maintain the standard of the whole.

Although the situation with respect to airmanship and aërial gunnery is quite satisfactory, the reverse is the case with regard to the art of aërial navigation. On the basis of the same report, naval pilots averaged during the year in question but seventeen *minutes* in the air on flights for which the practice of aërial navigation was the assigned mission. Eliminating, as was done in the consideration of aërial gunnery, the time devoted to training, we find that only one-tenth of 1 per cent of the total flying time was devoted to the practice of aërial navigation. Such a percentage is entirely out of proportion to the military importance of this art. Airmanship and the ability to handle aërial weapons are not more essential on the part of a naval aviator than proficiency in navigation. The ability to navigate aircraft might well be placed ahead of gunnery in the list of relative military importance. A squadron composed of competent aërial navigators is at least sure of getting into action in a naval engagement. Such a squadron would not be apt to miss its objective entirely or arrive at the scene too late to be of value.

As the average flight is usually for one hour, and as only seventeen minutes was the average time devoted by each naval aviator to the practice of aërial navigation, it follows that during the year in question many aviators had no opportunity to practice this art. The same might be argued with respect to aërial gunnery, and doubtless many pilots did not participate in a gunnery flight during the year. But, on the other hand, these pilots are certain to be afforded ample opportunity for aërial gunnery practice as soon as they are detailed to duty in an operating squadron. No such certainty exists with respect to aërial navigation. Many aviators in the service today have not attempted the navigation of aircraft since finishing the training course at Pensacola. Recently the practical course in aërial navigation was eliminated from the curriculum at Pensacola and it is quite easy to visualize within the next two or three years a very large group of naval pilots who have never had opportunity to qualify themselves as aërial navigators and who have never made a navigational flight. The basic problem of aërial navigation is a dead reckoning one. It is essential that the course steered be an accurate one, that the speed over the ground made good be checked carefully, and that the force and direction of the wind at the altitude be known within comparatively narrow limits. Very few naval aviators have ever compensated an aircraft compass and fewer still have ever calibrated an air-speed meter, and practically none have ever attempted to determine the force and direction of the wind while in flight—at least since becoming qualified pilots.

There are many ostensibly sound reasons for this condition. Navigation of aircraft has never received the attention its importance has warranted. This science has been relegated to a place so far in the background as to be nearly forgotten. Aviators as a class "talk shop" incessantly. In these conversations airmanship and handling qualities of planes receive the lion's share of attention. Aërial gunnery and other aërial missions are frequently discussed, while a discussion of aërial navigation is rarely heard.

The next most potent reason for the neglect of aërial navigation is the erroneous, although general opinion, that aërial navigation is quite simple. Very few long flights have been attempted, and, in shorter ones, the range of vision from the aircraft is so great that navigational errors are corrected almost subconsciously by visual reference to landmarks. Flights out of sight of land are rarely made and on cross-country flights the almost universal practice is to follow a railroad, highway, or river to the destination. Such conditions have naturally led to the general belief that aërial navigation presents no great difficulties. Nothing could be further from the truth. The aircraft compass is a small magnetic compass. During flight it is subject to many transient errors such as the effect of electrical circuits incidental to the operation of the power plant of the plane, the influence of vibration, and the effects of irregular and rapid pitch and roll. No mention need be made of the effects of landing shocks, of exposure, and of the effects of acrobatics. The determination of the force and direction of the wind is a comparatively complex problem and is one requiring constant practice if accuracy is to be maintained.

Upon the accuracy of this wind determination depends (compass and steering errors disregarded) the accuracy of the course made good over the ground. In the surface vessel the navigator lays down his course on the chart, applies the compass correction, and gives the result to the helmsman with every confidence that, unless extraordinarily strong currents are encountered the ship will make good the desired track over the ground. In the plane, however, the aërial navigator must, after laying down his course and applying the compass error, make a further correction for the drifting effect of the wind and then be on the alert for a shift in the wind. He cannot even call the direction in which the plane is pointing his course. This direction frequently differs so radically from the desired course that the term course would be a misnomer, so the term heading is substituted. A heading of northeast to make good a course of north is by no means unusual or startling. On surface vessels the revolution counter and the log afford the navigator a very fair idea of his actual speed. In aircraft the aërial navigator must first apply a calibration correction, which usually differs with different air speeds, to the reading of his air-speed meter. Next he must apply a further correction for the altitude (the air-speed meter underreads an amount approximately 2 per cent of the reading for each 1,000 feet of altitude above sea level). Then he must apply the retarding or accelerating effect of the wind vector along the line of flight. There are other problems with which the aërial navigator has to contend such as the cramped space available and the numerous other demands upon his attention, etc.

Next among the reasons for the neglect of aërial navigation is the comparatively recent introduction of the *Lexington* and *Saratoga* into the fleet as operating units. True, the *Langley* has been in operation for a number of years, but her mission has always been the training of qualified pilots in the art of carrier landings—a phase of airmanship. Aircraft carrier tactical dispositions and aërial tactics in connection with operations from a carrier are still so new that sufficient time has not elapsed to demonstrate clearly that aërial navigation is an absolute and imperative necessity for aircraft operating from these vessels. This holds true despite one incident which should have been convincing. On this occasion several entire squadrons, less than seventy-five miles from the carrier, were so uncertain as to their position as to raise grave doubts as to their ability to regain her deck. Some of the pilots were debating the question as to whether or not the best policy would be to set a course for the shore instead of for the carrier, when the carrier was fortunately sighted abaft the beam! It is true that up to the present time no plane has failed to rejoin its carrier because of faulty navigation, but this must be attributed more to the limited distances hitherto involved in aircraft operations than to the accuracy of the navigation. If the present neglect of aërial navigation continues, the carrier squadrons must be limited as to the distance at which they may operate from the carrier or incur the risk of a disaster unparalleled in the annals of aviation. It is unthinkable that the commanding officers of the carriers will accept this risk so the alternatives are the acceptance of this arbitrary and unnecessary limitation upon the over-all efficiency of the carriers and their squadrons, or the devotion of more time and effort to the perfection of our pilots in the art of aërial navigation. If it is impossible or undesirable to make this effort, we might as well redesign the carrier planes to take advantage of their decreased range of action by improving their performance in other directions such as speed, climb, and maneuverability.

It must not be construed from either the foregoing or from subsequent statements in this article that the writer intends or implies any criticism of policy, individuals, or group of individuals. It is intended only to point out a condition that must be considered as holding elements of danger, unless the service is content to limit the effectiveness of the carrier aircraft squadrons to a point where they are substantially "tied to mother's apron strings." A possible remedy for this condition is suggested.

Before entering into a discussion of a remedy, one of the available methods of navigating aircraft is in order. As conditions in lighter-than-air ships are quite different, this discussion will be confined to the necessities of heavier-than-air craft. To the average officer in the service the word navigator connotes the use of a sextant—in short, astronomical observations for the determination of the position. In aircraft

the main dependence must be placed on aërial dead reckoning. In the first place, navigation by means of astronomical observations is impracticable in many service planes, as the navigator must act as pilot and the demands upon his attention would be too great to permit taking, much less utilizing, celestial observations. Even in planes provided with two pilots the demands upon their attention must be considered too great to permit this form of aërial navigation. Only in planes carrying a crew large enough to allow one man to devote his entire attention to the duties of navigation is this form at all practicable and such planes are not to be found among the carrier complements. Dead reckoning, despite the difficulties previously mentioned, is more accurate than the determination of the position by means of astronomical observations within the distance limits imposed by the limited fuel capacities of carrier planes. In setting a course for a plane the drift due to the wind has a comparatively great effect upon the track of the plane over the ground. And, as the determination of the force and direction of the wind is the greatest problem in aërial dead reckoning, it follows that, no matter what other means of navigation are used, dead reckoning must also be employed. Even granting that an accurate position may be obtained easily and quickly the pilot cannot hope to reach his objective directly, or regain his carrier without trouble, unless his dead reckoning is accurate. The aërial navigator's problem is just as much "how to get to where you want to go" as it is "where you are." Hence, except for large shore-based planes carrying a large crew, time devoted to the practice of aërial astronomy is for all practical purposes, time wasted.

As to the remedy for the present neglect of aërial navigation, the first step would be the re-introduction of its practice in the air as a part of the course of training at Pensacola. This may not be possible at present for reasons not pertinent to this discussion, but will be an eventual necessity. This course will probably cover the following ground. Each student will be required to compensate an aircraft compass on the ground and to check its accuracy by actual flight tests. Each student will be required to calibrate his air-speed meter. Several determinations of the wind while in the air will be required and the accuracy of the student's results checked by means of aërological observations. The student will then be ready for actual navigational flights. These flights may be made inland, for if the student is required to fly to a designated objective and from there to a second objective (both objectives being designated by latitude and longitude) and to arrive at the second objective at a certain time while flying at a certain given air speed, the student will receive no aid in his navigation by the presence of known landmarks. Such inland flights would remove the necessity for a surface vessel to guard the flights and would also reduce the hazard in case of poor navigation.

As far as the qualified pilot is concerned the remedy is not quite as simple. The first step is logically the indoctrination of the individual as to the necessity for aërial navigation. This may give rise to complexities. Any increase of time over that used at present must be taken from that devoted to other purposes. How or where this may be accomplished the writer does not venture to suggest, other than to speculate upon the advisability of an advanced training course for the qualified pilot prior to his being detailed to a carrier squadron. However, certain minor suggestions seem feasible. All pilots making cross-country flights could, in the absence of the necessity for the avoidance of rugged or desert country where a forced landing might involve undue hazard, be required to steer the direct route instead of following a railroad or other landmarked route, thus imposing the necessity for navigating the plane by dead reckoning as well as by piloting. Next, each aviator could be required to compensate the compass and calibrate the air-speed meter of his own plane at least once each quarter, instead of leaving these duties to the squadron navigator. Finally, a navigational feature might be introduced into the gunnery competition by requiring on one practice the squadron in question locate its targets within a certain specified time after taking off and prior to delivering the attack.

AIRCRAFT IN JOINT MILITARY-NAVAL OPERATIONS

By Lieutenant Commander E. W. Broadbent, U. S. Navy

THERE are few, if any, operations of modern warfare that present a more complex problem than do joint military-naval operations. The development of aviation now adds even further complications to those which have heretofore confronted the commander of a joint operation. Up to the present time no joint expedition has been undertaken in which aircraft have taken an important part. They played a minor rôle in the Japanese attack on Tsingtao in 1914, and again in the British attack at Gallipoli. These air operations, limited though they were, suggested the immense potential value of aircraft in joint operations.

Since the primary object of a joint military-naval operation is to place troops on shore where they may gain control of hostile territory, the aircraft, like the naval vessels involved, must perform an auxiliary and contributory task. It is their duty to provide security for the attacking forces from air attack, and to assist the attacking forces by reduction of the hostile resistance.

Security from air attack can be made absolute only by the complete destruction of the opposing air forces. Whether or not such a measure of security can be attained is problematical. Failing absolute security, there must be gained at least that degree of superiority that will enable the attacker to employ the air services to advantage. However, so marked would be the attacker's advantage were he enabled to use the air freely, that every effort should be made to gain and maintain command of the air. We may then take as the general mission of the air forces in a joint operation "to support the landing force by gaining and exercising local command of the air."

Air forces of the defense.—The air forces are no less valuable in defense against a joint operation than in the attack. It is probable that so long as command of the air rests with the defender, any considerable landing attack is doomed to failure. The defense has a marked advantage in that destruction of the attacker's floating bases would likely compel the withdrawal of the landing force without the necessity of defeating that force in a land battle. The dependence which a considerable landing force must place upon its bases is so great as to magnify enormously the value of aircraft to the defenders. The development of modern aviation has served to increase the distances between forces in action. After the Battle of Jutland, Admiral Scheer said that the battleship remained the undisputed "backbone" of the fleet because of its "long reaching" great guns. The long reach of aircraft has already injected into the problem of the defense of sea frontiers an uncertainty that challenges imagination. Here the advantage is with the defender, because if with the long reach of his air arm he can keep would-be invaders at a distance, he is secure. The invader, on the other hand, must come to grips, must land troops, occupy territory, or his invasion fails. Manifestly, in the defense of a sea frontier, whether it be of a base, or a coast line, the farther to seaward the defense can be extended the more secure the frontier will be.

This will be recognized as an ancient doctrine of national defense. It has led nations to seek their security on the enemy's coasts, in a vigorous offensive. However, such offensive operations, if at a great distance from the home bases, must be preceded by preliminary joint operations for the establishment of advanced bases. These operations will, in all probability, bring the invader within the radius of highly concentrated defense forces, particularly land-based aircraft. The increasing unpopularity of offensive wars places a growing value upon the weapons of defense. It has always been difficult to impress upon the non-military mind the value of a determined offen-

sive. With the present widespread desire for lessening of armaments this difficulty will increase.

In the defense against a joint expedition, we may expect to find two major groups of air forces, namely: those air forces projected far to seaward incorporated in a cruising fleet; and those air forces engaged in local defense, based upon shore bases in or near a critical area. The first group are the concern of purely naval forces; the second group concern the joint expedition, and may constitute its first menace. Only the latter group will be considered here.

The primary task of the force guarding a sea frontier or a naval base is to provide for the security of its assigned area. For this purpose it must employ forces that will most effectively serve for information and security. In this work the advantages inherent in the use of aircraft are marked, although they have certain natural weaknesses. Their great speed enables them to search large areas in a short space of time, thus decreasing greatly the probability of a surprise descent upon the coast by a large joint expedition. The effective areas off a coast can be greatly extended by using small bases on outlying islands, and by the use of seaplanes operating from tenders. The purpose of these operations is to gain early information of the approach of hostile forces.

The most vital area to be covered by the scouting forces lies within the line from which an invading force can reach the base during the hours of darkness. For a large expedition carrying troops a night run would scarcely exceed 150 miles. If the attacking force is composed of aircraft to be launched from a carrier, the search area must extend to seaward as far perhaps as 700 miles, the full cruising radius of attacking planes plus the run of the carriers during part of the night. Except under most exceptional circumstances it would be impracticable to conduct daily effective air search of such a great area. This lays an additional burden upon the close-in defenses of the base. These forces must be prepared to take the air in adequate numbers on short order to engage attacking air forces.

Submarines may operate against a base by laying mines, by attacking with torpedoes vessels entering or leaving the base, or by engaging in reconnaissance. Aircraft offer a very satisfactory means of detecting and attacking such vessels. For this duty both lighter-than-air and heavier-than-air craft are suitable, the former being adapted to observation tasks, the latter to both observation and attack.

If an attacking expedition should reach the vicinity of the base, the defender must call upon all known types of aircraft. He should have bombers and torpedo planes to attack the transports and their supporting vessels; attack planes for offense against troops disembarking and on shore; chemical warfare planes for smoke screens and gas attacks; artillery observation planes or balloons; and fighting planes for the protection of the various air forces.

It is apparent from the brief description of defensive air operations that two general classes of air service are involved: (1) for extensive flights over water; (2) for flights over and in the immediate vicinity of land. In the first class, the naval air service is best qualified by equipment and training. In the second class, the Army air service predominates. Incorporated in the naval air service is a comparatively small group of Marine Corps personnel who are trained to some extent in both classes of service. The necessity for including in the air defenses of a base, personnel and material suited to both classes of air operations, is obvious.

The value of ground anti-aircraft defense is problematical. It is certain, however, that such defenses do provide some measure of security for aërodromes and other critical points, and would be included in a base defense system.

In the conduct of the aërial defense, as in all other military operations, the value of a vigorous offensive must be well understood. Waiting for the blow to fall in the expectation of parrying it or executing a skillful riposte is almost certain to lead to failure. If adequate forces are at hand for a well-directed attack, the most likely road to success lies in their employment in a well-trained, properly directed attack.

First of all, the full strength and composition of the invader must be determined, either by aircraft, or surface craft, or both. Thereafter, his forces must be trailed and their destination, routes, and probable intentions determined. As soon as the convoy enters the area of offensive operations of the defense, the attack should begin. In this phase of the operations, there are three ob-

jectives open to attack: transports, supporting surface vessels, and supporting aircraft.

It is certain that the loss of his transports would force the invader to withdraw, and the loss of one or more of them might seriously embarrass him. The loss of his supporting surface vessels would increase the difficulty of his landing operations. Yet both of these types of craft will be protected by aircraft from the decks of carriers. Likewise, the bulk of the attacker's air strength for immediate use would be carried in carriers. To lose these vessels would practically nullify his plans for the general employment of aircraft. Such being accomplished, his transports and surface vessels will later fall an easy prey to the defender's remaining aircraft, shore-based planes not fitted for long flights over the sea. Therefore, one may safely conclude that the first objective of the defending air forces is the air force of the enemy in his carriers. While such vessels may not be sunk by aërial attack, they can be rendered useless as floating landing fields. This cannot be accomplished without a fight, unless the invader be surprised. Therefore, the attacking bombing and torpedo planes must be supported by fighting or pursuit planes. No time should be lost in getting in this attack, for if the invader attacks first, he may gain an initial advantage that cannot later be wrested from him.

Should the invading forces succeed in piercing the initial defense and establish a temporary shore base from which to operate their aircraft, this base and its forces may become a legitimate objective. It is possible that purely land planes rather than naval planes could be used against such a base. In fact, the similarity between certain types of Army and Navy planes, their capabilities, and functions may lead to difficulties. For example, suppose that a part of the invading expedition were known to be establishing a temporary air base within attacking distance of the defended area, and at the same time, the main body of the hostile expedition had not been located. Should all available air forces (if such strength were required) be directed against the enemy air base, or should the naval air forces be reserved for action against the main convoy when discovered, thus reducing the base-attacking force to inadequate proportions? The task of air defense must first be viewed as a whole; all probable operations should be studied and planned for; there must be whole-hearted, well-directed coöperation; and above all a unity of command by which the relative importance of various tasks can be determined and appropriate action taken. If this is not done, disastrous violations of "economy of force" may leave the defenders bereft of suitable forces at critical times and places.

The preliminary air operations, if successfully conducted, should gain for the defenders a workable superiority in the air as the attack develops. Transports are especially vulnerable to air attack. They are unarmored, and possess little defense against underwater attack. Their decks, crowded with troops, are wide open to effective light bombing attacks. Similarly, the troops embarked in small boats for landing are almost defenseless against attack from the air. Unless the hostile air forces have been completely destroyed, these attacks must be supported by pursuit planes to clear the way and prevent interference. Further, this phase of the landing operations may take place during darkness, necessitating special groups of planes for dropping parachute flares or floating candles. When the landing operations have gained for the invader a foothold on the beach, the functions of the defender's aircraft become the same as in any other land operation. Even now, however, successful attacks against the invader's floating bases may so seriously threaten the support of his troops ashore as to compel the withdrawal of his landing forces and the abandonment of the attack.

The invader's aircraft.—Unless the present ideas as to aircraft carriers, their size and numbers, change considerably, it is hardly likely that all the air forces of a landing expedition will be embarked in carriers. The only alternative is to carry the additional aircraft knocked down, boxed or crated, in auxiliary vessels. This makes necessary the establishment of one or more temporary air bases in the general vicinity of the object of attack. Furthermore, with the limited aircraft in carriers at his immediate disposal, it is scarcely likely that the invader can take the risk of sending these craft away from his troopships until he can be assured of a satisfactory air superiority by the addition of aircraft from his temporary shore bases. This may result in delaying the arrival of the main convoy until preliminary

operations have established the necessary air bases on shore.

In the development of the air attacks we have several distinct phases: (a) the period during which superiority in the air is maintained by carrier-embarked air forces alone; (b) the period during which superiority is gained by carrier-embarked planes plus shore-based planes; (c) the period of the main attack in which the air operations are predominantly directed by the operations of the landing force on shore.

From the air point of view, the critical period for the invader is the first of these phases. Defending fighting planes cannot be kept in the air continuously, and considerable time is required for taking off from carrier decks and concentration in the air in fighting formation. The rapidity with which air attacks develop requires that all available fighting planes be kept on deck on the alert when hostile attacks are expected. The objectives of these planes are the bombardment and torpedo planes of the defenders, which constitute for the moment the principal menace to the expedition.

During this phase, aërial reconnaissance of the area selected for attack may be undertaken. This is in the nature of an independent operation, and may be dispensed with altogether if the area is already known, or if the reconnaissance tends to imperil the success of the main operations by the sacrifice of surprise or reduction of forces.

It may be that the length of the first phase will be determined by the time required to establish the much needed temporary shore bases. Considerable time is required for uncrating, assembling, testing, and fueling planes. This time can be shortened somewhat by assembling some of the planes aboard ship and flying them ashore. The base operation is not a simple task, especially if facilities for landing and handling the bulky plane crates are lacking ashore and must be supplied from shipboard. Air and sea superiority in the vicinity of the base is indispensable, for it is during the confusion of establishing the base that the gravest menace from attack exists. So great is this menace that the needed air superiority may have to be supplied by planes landed and assembled at some other point well outside the radius of action of the defender's forces, and flown up to the point selected for the temporary base. Such step by step advances take time.

So important is this preliminary building up of air strength that the advance of the main body into the range of the defender's aircraft may be delayed until air superiority is assured. The task of the landing force may be rendered more difficult by this delay than if it were unnecessary. On the other hand, without air superiority there is a very excellent likelihood that the landing operation would fail altogether.

Once the invader gains superiority in the air by his land-based planes he may move with certainty against the defensive air forces. The initiative of offense which has heretofore rested with the defender now shifts to the superior forces of the invader. Here a vigorous offensive presents the most favorable opportunities of success, and success means the immunity of transports from attack. This immunity can be gained only by locating and destroying the air forces of the defense, at the best a difficult task. Should these attacks be unsuccessful, the attacking forces will be thrown back upon the defensive when the actual movement of troops ashore begins. The aircraft of the landing force now assume purely military rôles in support of troops as in any other military operation. Naval aircraft will be engaged in defense of the vessels of the convoy and supporting vessels, naval gunfire observation, and if their numbers permit, reënforcing the military planes.

It would be stating the case mildly to say that the air above the landing forces will be full of aircraft. A greater confusion of air conditions can scarcely be imagined, with smoke screens, gas clouds, parachute flares, and planes of every description racing at full speed in divisions, squadrons, and groups. The resourcefulness of the air services will be tested to the utmost, and success will fall to the best prepared. Aviation has indeed added new difficulties to an operation that already possessed so many difficulties as to render it almost impossible. However, should either the invader or the defender succeed in gaining command of the air, and be able to exercise it freely, he is practically assured of success, at least in the early stages of the invasion.

THE PORTRAIT OF A MADCAP ADMIRAL

By H. A. De Weerd, Department of History, Denison University

. . . you are right,
One must become fanatic—be a wedge
A thunderbolt—to smite a passage
Through the close-grained world.—John Davidson

TWO men were conversing in a time-honored castle in England. A short, heavy, bearded man puffed a black cigar "fat as a capstan bar" and listened. A smooth-shaved, compact, bulletheaded man in a morning coat was talking. The man talking grew excited; he punctuated his explosive sentences with sweeps of his arm, and from time to time his fist shook under the nose of the bearded man like the hammer of an erratic riveter. As the monologue grew in dramatic force and the gestures of the talker became more violent, the bearded man good-naturedly stopped the menacing fist—King Edward VII was taking a lesson in war, Holy Writ, Nelson, and water-tube boilers from his principal naval aide-de-camp, John Arbuthnot Fisher, Baron of Kilverstone and Admiral of the Fleet.

Lord John Fisher contributed a lively and integral part to the background of "Edwardian" England. Entertainment never lagged with the admiral about; he was often seen at table with the King, and generally was present at garden parties and receptions. Decorated with orders "like a damned Christmas tree" or dressed in rough tweeds and black tie (perpetual mourning for Nelson) Fisher was always the same: burly, forceful, mischievous, witty, irresistible to most women and to all men possessing a sense of humor. If there happened to be a band about, Lord Fisher would organize an impromptu dance. Like as not he would ask the King to move out of the room so that the rugs might be rolled up.

The most distinguished British naval officer since Nelson was born at Rambodde, Ceylon, January 25, 1841, the son of Captain William Fisher, of the 78th Highlanders, and Sophia Lambe. The Fishers seem to have been vigorous people; their motto was, *ubi voluntas ibi piscatur* (we fish where we please). When one of his ancestors built a wing on Balliol College at Oxford and was asked what inscription he wished carved on it, he replied, *Verbum non amplius—Fisher*, which John Fisher gleefully translated, "Fisher—not another blessed word is wanted." Fisher showed himself equal to his family traditions by stubbornly refusing to be weaned at nine months. He was recommended for the Royal Navy by Sir William Parker, the last of Nelson's captains; and entered the great admiral's flagship *Victory* on July 12, 1854. Upon boarding the vessel the young candidate was subjected to a medical examination, wrote out the Lord's Prayer from dictation, saw eight men flogged, and fainted at the sight. He was then thirteen years old.

Soon Fisher became hardened; life in the Royal Navy was not easy on young midshipmen. In later years he wrote, "I have always had to fight like hell and fighting like hell has made we what I am. Hunger and thirst are the way to Heaven." The Crimean War broke out the year Fisher entered the fleet and he saw service in the Baltic aboard H.M.S. *Calcutta*. At the termination of the war he was transferred to the Chinese station under Sir Launcelot Shadwell. Here Fisher took part in a landing party whose objective was the capture of a pirate stronghold. The fight was a very bloody one indeed; over half of the landing party was killed or wounded. Shadwell, severely wounded, gave young Fisher his studs with the motto *loyal au mort*. These studs Fisher wore daily for over sixty years.

Fisher's promotions came rapidly. Admiral Sir James Hope believed that favorit-

ism was the key to efficiency and appointed Fisher to the command of H.M.S. *Coromandel* at the age of nineteen. Once he was promoted because he wrote a large hand which his superior could read without his glasses. At another time he advanced because his captain lost his mind and on return to England could only pronounce one word—and that happened to be "Fisher." Again he was promoted because he was the only officer serving under "furious" Captain Oliver Jones who was not arrested at some time or other. Jones, who was one of the most exacting officers afloat, wrote tersely of Fisher: "As a sailor, an officer, a navigator, and a gentleman, I cannot praise him too highly." When John Fisher arrived in England with this letter from Oliver Jones, the Admiralty gave him a first-class certificate without asking a question.

The Royal Navy had gone to dry rot in the half century of inactivity which followed the victory of Trafalgar, and the greatest share of its intellect and energy was expended in making the ships "look pretty." Gunnery and fighting efficiency suffered greatly because of the "housemaiding" which went on in the ships of the fleet. There were any number of officers who had suggestions for improving the service, but reform was not popular and the ponderous lethargy of the Admiralty discouraged all but the most resolute. Fisher felt that the prime business of the navy was fighting not primping. He strove for reforms with all the fury of the Old Testament prophets, often employing their very language. Nelson became his idol and he assumed the task of interpreting this erratic and gallant admiral to his fellow-sailors. He took as his own the word "Nelsonic" which he applied to traits of character and concepts he admired, while he carried a whole cartridge belt filled with invective which he could fire off in machine gun fashion against the things he detested: sloth, stupidity, and Admiral Buggins, which was Fisher's name for any officer who received promotion solely on the basis of seniority.

"The Lord suffereth violence," said Fisher, "and the kingdom of Heaven is taken by storm." Through a series of fortunate advances he left his professional rivals far behind in 1904 when he was made first sea lord under Lord Selborne. At last Fisher had power to put into operation his many ideas for the improvement of the Royal Navy. The same year he was appointed principal naval aide-de-camp to King Edward, and this greatly strengthened his position. For no matter how his enemies might gossip and revile, King Edward dearly loved the vigorous admiral. It is said that Fisher laid down seventeen conditions upon which he would take office; when they were accepted, he joined the government. "If I've got to kick people's shins I want to kick them all at once, so that while they are rubbing them I can get in some good work."

So revolutionary in character was the "good work" which Fisher undertook, and so unexpected the speed with which he accomplished it that Englishmen rubbed their eyes in plain amazement at the transformation effected in the Royal Navy. With a few strokes of the pen, he scrapped 160 ships, which though rich in tradition were too old to fight or to run away. This done Fisher concentrated the bulk of the fleet in the North Sea facing the new German Navy. The first sea lord was early convinced that a war with Germany was inevitable, and he entered the ranks of the prophets by asserting that it would take place in the summer of 1914. "The dusky hues of glorious war" brought from the admiral gasps of anticipation, and he welcomed the idea with astounding proposals breathed in the royal ear of King Edward to "Copenhagen" the German fleet at Kiel as Nelson had done the Danish fleet in 1801. "But alas we had no Pitt, no Gambetta." When the Germans brought out menacing Navy bills he trumped their trick in 1905 by laying down the *Dreadnought* and roared with delight (in many a letter) at their consternation. During the six years in which he was in power, Fisher did more to modernize the British Navy than anyone else could have done.

The water-tube boiler, the all-big-gun ship, the introduction of the submarine, the common education scheme, the system of nucleus crews for ships in reserve, the concentration of the fleets in home waters—the great naval programs of 1908 and 1909, the advance from the 12-inch to the 13.5-inch gun—all in the main were his.

It was manifestly impossible for such a "ruthless, remorseless, relentless man" as Fisher was, to have accomplished the great innovations in the fleet without arousing most violent opposition. Instead of avoiding controversy Fisher seemed to take a perverse delight in it. He proclaimed from the

housetops the fact that officers in the service who opposed his policies would find themselves on dry land and half pay. The huge number of "retired" officers on the Navy lists showed that the old admiral meant what he said. Gradually the opposition to Fisher's tenure of office organized around the figure of Lord Charles Beresford, Commander of the Channel Fleet. Beresford, who ably represented the social traditions of the service, consistently opposed every action of the first sea lord. Fisher gleefully made it a battle to the death; and poured abuse and ridicule on Beresford, while the enemy replied from press and magazine. The quarrel split the service into two hostile camps, and the traditions of Nelson's "band of brothers" seemed shattered beyond repair. The controversy was fatal to both Beresford and Fisher; for although the latter had the intense satisfaction of seeing Beresford lose his command, Fisher, like Achilles, was wounded in the heel before the moment of triumph, and the wound proved to be mortal. He rashly published a letter from Captain Reginald Bacon, who was a subordinate to Beresford, describing a meeting of the King and Beresford in which the chief issues of the Fisher-Beresford controversy were discussed. The example of a first sea lord boldly encouraging insubordination could not be tolerated. The political wolves in England took up the cry, and Fisher left the Admiralty to plant roses at Kilverstone, later to wear out his white ducks and tunics in sunny repose in Switzerland. The roses he planted at Kilverstone were the source of many a story at the Admiralty. A new officer asked an old hand who knew Fisher if he thought the roses would grow. The older officer replied, "They'd damn well better."

From the placid shores of Lake Lucerne Fisher poured a steady stream of violent and striking letters into the dispatch box of Winston Churchill, the new first lord of the Admiralty. Advice, encouragement, invective followed each other in kaleidoscopic fashion. Recondite were the quotations from Blake, Nelson, Shakespeare, and Isaiah. Any proposed change in the fleet which did not fall into his scheme of things, or which seemed to Fisher to be a waste of money, brought a swift message from the admiral. When rumors of the naval program of 1912 reached Fisher, he wrote at once to Churchill:

> I can't support you at all in any way whatever for any two year, or more, program. Some damned fool has got hold of you to make you say that! The great secret is to put off to the very last hour the ship (little or big) that you mean to build (or perhaps never build her at all!). You see your rival's plans developed—you plunge with a design 50 per cent better. —So don't be a damned ass and deliberately lay down a ship which you know is (going to be made) obsolete by some sudden vast step in old Watt's brain. Sufficient for the year is the program thereof! For God's sake get that written up somewhere for you to look at when you get out of bed in the morning! And do please tell me the name of the born fool who hoaxed you. Is it ———? We are asses now for not building a 16-inch gun—but you can't help yourself any more than you can help laying down ships for the line of battle that go less than 30 knots. There are certain things, my beloved Winston, that even God Almighty can't help (let alone you!). He can't for instance help two added to two being four!

Fisher who was always clamoring for more speed in the new ships of the fleet, kept reverting to this theme in his letters.

> The most damnable person for you to have any dealings with is a naval expert! Sea fighting is pure common sense. The first of its necessities is speed! —I had a letter from Jellicoe——. His one, one, one cry is speed! Do lay that to heart! Do remember the receipt in Mrs. Glasse's cookery book for jugged hare! First catch your hare!

All of his letters were "dashed off red hot" without restraint, and their racy style became associated with the blue water admiral's erratic conduct. A single line of Fisher's to the Grand Duchess Olga of Russia has become internationally famous. Olga had written a long letter to Fisher describing a picnic of the royal family at which the absence of the witty admiral and the presence of gnats which bit her ankles were the only sources of complaint. Fisher wired back, "Would to God I were one of the gnats."

John Fisher hated the printed word, felt that it could not convey the aroma of the soul, and was no vehicle for his fiery volcanic temperament. When under headway in brilliant talk, Fisher was irresistible. The rapidity with which he plunged in conversation from one subject to another left his listeners breathless and panting far behind. "After an interview with Lord Fisher you suffered from that giddy, bewildered, exhausted sort of feeling that no doubt has you in thrall when you have been run over by a motor buss without suffering actual physical injury." So profound was the impression which he made on Winston Churchill, that

the first lord was on the verge of taking him back into the Admiralty in 1911, but felt he could not risk it in the face of the "Bacon letters." The old admiral had the supreme satisfaction, however, of being called into the fighting arena when the guns began to shoot in 1914.

The war turned public attention to the man who had made Jellicoe and the Grand Fleet. After the first hysterical months of the war had passed without decisive engagement at sea, the public found time to criticize the activities of the Royal Navy. The record of the fleet was not impressive. The German Admiral, Count von Spee, was still at large and had just slaughtered Christopher Cradock and a British squadron off Coronel. In a single morning an old German submarine, the *U-9*, sank three large cruisers off the Broad Fourteens. The Admiralty needed a strong man to recapture public confidence; Winston Churchill called in Lord Fisher.

Fisher was then seventy-four years old, hale, bluff, apparently strong as ever.

> As in a great castle which has long contended with time, the central mass of the donjon towered up intact and seemingly everlasting. But the outworks and battlements had fallen away and its imperious ruler dwelt only in the special apartments and corridors with which he had lifelong familiarity.

He fell to the tasks of war with a sort of apocalyptic ecstasy and fury. Scriptural phrases for striking down enemies were heard; Nelsonic poses were struck; annihilation not victory became the watchword. With instant decision Fisher acted; Von Spee was clawed to death by battle cruisers off Falkland Islands. In a single stroke the seas were cleared, and the Royal Navy eagerly sought for the proper sphere of a naval offensive against Germany. Plans for a land and water attack by way of the Baltic Sea were formulated.

Working from five in the morning until eight at night, Fisher threw himself into the Baltic venture with all his vigor. Gathering his assistants about him, free completely from the galling restraints of the treasury, he indulged in a wild orgy of ship construction. Enlisting the aid of America and sweeping aside every vestige of red tape, he conceived of a vast armada of over 600 vessels to be completed in the year 1915. The Fisher touch thrilled the Navy and the Admiralty "quivered like one of his great ships driven at its highest speed." Elizabethan and Napoleonic traditions seemed on the verge of being outdone, and when a minister of the Crown visited the fleet, a quiet admiral caught him by the sleeve saying: "First Lord I wish to speak with you in private, Nelson has come again."

As these mighty preparations for the coming day absorbed the whole interest of Lord Fisher, Winston Churchill, whose eager undisciplined mind was constantly exploring new ways to victory, committed the Navy to an attack upon the Dardanelles. The beginning of the naval attack seemed auspicious, but with the slowly mounting certainty of a Greek drama, Great Britain was enmeshed deeper and deeper in the undertaking. Participation in this expedition sapped the strength of the North Sea Fleet, and Fisher, who was never enthusiastic about the Dardanelles affair, grew more outspoken in his opposition to Churchill's plans. The memories of old triumphs and the hope of new ones kept the two men in harness for a time, but finally Fisher decided that things were heading for disaster. Suddenly and dramatically he resigned.

Fisher's resignation shattered the false calm of a tense and complex political situation. The bloody battles of the year 1915 had aroused a storm of criticism against the government. Repington's famous "shell letter" to the London *Times* caused vicious attacks upon Lord Kitchener. Andrew Bonar Law and the Conservatives were resolved to oust Winston Churchill or die in the attempt. A change in the government seemed inevitable when Fisher's resignation surprised the official world. Had his resignation been delivered in the ordinary manner, it seems probable that he would have been returned to the Admiralty as first lord, and that Churchill would have been placed in another position. As it was Fisher caught Lloyd George by the sleeve, told of his intention to resign, walked home, locked the door, drew the blinds, and refused to answer the bell. Even when the prime minister and friends came pleading for admittance, the old admiral only growled through the door and peered under the shade. Finally he admitted Mr. McKenna who had once saved him from the wrath of his enemies, and after all the eloquence of McKenna failed to deter him, Fisher sullenly headed for Scotland.

This was on May 15, 1915. The shock

broke down the government. An unexpected element, however, seemed to intervene to save the political scalp of Winston Churchill. On May 17 news came that the German High Seas Fleet was in the North Sea. Churchill, working without a first sea lord, picked up his fallen cards and in a desperate gamble threw every fighting ship in the Royal Navy across the path of the German fleet. Tense, white-faced, silent men in the war room of the Admiralty watched the moments tick by which might bring about a collision of the mighty squadrons on blue water. A savage battle to victory would leave Churchill in an unassailable position. The stakes on the board were incalculable. Telegram followed telegram, bringing vague information; finally it appeared that the mists of the North Sea had once again covered the retirement of the German ships.

Down from Olympus came Churchill; and the outcome of the fall of the government was no less pleasing to Lord Fisher. The board of Admiralty was reconstituted under Lord Balfour and Sir Henry Jackson. In the cool of his Scotch retirement Lord Fisher's fine frenzy soon turned to resentment. It became increasingly clear that the reverses at the Dardanelles would make any attempt at an amphibious operation the target of a thousand criticisms. Britain had by this time wandered into another commitment at Salonika and this taxed her shipping to the limit. Since Lord Fisher was notoriously a one-idea man, his return would mean the revival of the Baltic plan, and to the minds of most men, the Baltic plan was as dead as a dried herring. Caution and lethargy came back to the Admiralty. "Eating his heart out in solitude" and walking ten miles a day, Fisher held his peace as long as he could. When the "wait and see" policies of the Admiralty allowed the German submarine menace to grow unchecked, he turned to his pen. Bold were the claims be made. "I can crush the present German submarine menace in two months, but I must have power! I must be able to say to the men I employ: Do what I say or I'll make your wife a widow and your house a dunghill (and they know I would!)." Field Marshal Sir William Robertson gives an intimate glimpse of the old admiral in the period of his retirement. They were dinner guests of Lord Rosebery. Fisher was holding forth on the subject of the submarine menace. Gesturing energetically with his fork, Fisher would drive the prongs through his host's tablecloth as the imaginary submarines perished. After a time Lord Rosebery tactfully called attention to the havoc he was creating; Fisher was all apologies, but in a moment engrossed in his words down came the fork.

Fisher strongly opposed the "wait and see" policies of the new Admiralty and the program of concentrating all military effort on the Western Front where bumps in the ground were purchased with a deluge of British blood. The sight of a navy "five times as strong" as that of the enemy remaining inactive while millions of men were dying in the west was more than he could stand. He rasped out in exasperation, "Can the Army win the war before the Navy loses it?" He invoked the muse of history and of poetry to vindicate his naval policy.

> Time and the Ocean and some guiding star
> In high cabal have made us what we are.

His most strenuous efforts were unavailing. Britain had resolved to muddle through on the Western Front cost what may.

When the rivers of blood had been spilled, and the Empire, with the reckless sacrifices of the new world, had managed to win a decision, Lord Fisher could not feel exultant. The cost had been too great; victor and vanquished were alike exhausted. When the long line of trim grey ships moved out of Wilhelmshaven on November 20, 1918, and surrendered to a twenty-mile double line of Allied fighting ships, some act of thoughtlessness or malice made it impossible for the old admiral to witness this crowning glory to his life work. Embittered but still full of fight and wit, Fisher refused to make a personal attack upon his enemies. He held his fire and sadly reviewing the history of the war remarked: "We are really a very peculiar people; lions led by asses!"

As soon as the war was over and the need for an overwhelming naval force had disappeared, Fisher at once urged drastic naval reductions and economy. Loudly he warned his countrymen against the "criminal folly" of building a navy against the United States of America. His scheme for naval reduction and disarmament was simple. England and America should join hands and say to the power which disturbs the naval balance, "Stop building or we will 'Copenhagen' you here and now."

NOTES ON AËRIAL NAVIGATION

By P. F. EVERITT, B.Sc., F. Inst. Phys., F.R.A.S.

IN AN article on "Aërial Navigation," by Lieutenant Commander Weems (U. S. Naval Institute PROCEEDINGS, vol. 55, No. 314, April, 1929), the subject was divided into four sections, the fourth of which, celo-navigation, was defined as that part of aërial navigation in which the position of the observer is found by observations of heavenly bodies, the sun, moon, stars, and planets.

In these notes it is proposed to deal only with celo-navigation and to describe the two instruments officially designed and adopted by the Royal Air Force for this purpose. These instruments have also been adopted by many other European aviators and were used by the Marquis de Pinedo on his flight to America.

The first instrument is the R.A.E., Mark V, Air Sextant. This instrument does not use the natural horizon or, as often occurs, the false cloud horizon, except indirectly. All observations are referred to a bubble. This bubble is not an air bubble but a vapor bubble which can be controlled as regards size with great precision. The construction adopted consists of two chambers connected by a small opening. The bubble chamber has its upper and lower containing surfaces of glass, the lower surface of the upper glass being ground and polished accurately to spherical form. The second chamber below and on one side of the bubble chamber is of metal, one side being made as a corrugated diaphragm. By means of suitable screw gear the diaphragm can be pulled out to any desired extent and also allowed to return slowly to a free position. The system is completely filled with volatile liquid and cleared of all air, free or dissolved, and finally sealed off. The screw gear consists of two screw nuts, the larger one being adjustable as regards distance from the bubble-gear diaphragm with a central clearance hole through which a screw rigidly attached to the center of the diaphragm passes, and a second smaller nut running on the screw attached to the diaphragm center, so that when the smaller nut seats against the larger a pull is exerted on the diaphragm which consequently enlarges the volume to be filled by the volatile liquid; the liquid can no longer completely fill the space provided and must therefore volatilize to such an extent as to fill the extra space with its vapor. By controlling the volume of the system, the vapor bubble will be brought to any desired size. When not subject to acceleration(as it generally is in any aircraft) the bubble will take up its position with an accuracy of about $\pm$ 1′ (one minute of arc).

The optical parts are few in number and consist of two achromatic collimating lenses, one right-angled, and one pentagonal single reflection prism, one plano-parallel, unsilvered index mirror and two tinted plano-parallel light-reducing shades that may or may not be used at will. No telescope is required and nothing would be gained by attempting to use one as the unaided eye can quite readily distinguish one minute of arc.

The optical parts are arranged as follows: light enters the instrument horizontally and passes through one of the lenses after which it is reflected downwards by the right-angled prism, coming to a focus in the plane of the bubble; after passing through the bubble chamber it is reflected by the single reflecting pentagonal prism upwards at an angle of 45° abaft the vertical, passes through the second lens, and then strikes the unsilvered index glass where some is transmitted and some reflected. At night a lamp is inserted between the right-angled prism and the bubble system. The second lens is adjusted so that the image of the bubble is thrown to infinity and we therefore only have to deal with a beam of parallel rays. This beam of parallel rays from the bubble and lens after passing through the plano-parallel index glass combines with or is superposed on the rays of the sun reflected from the upper surface of the index glass. These rays will have been previously weakened to a suitable extent by passing through one or both of the

dark shade glasses which are mounted so as to be capable of being swung into their path either perpendicularly or inclined at any angle, thus obtaining a continuous range of adjustment of the brightness of the sun's image.

The index glass is pivoted at one end and controlled by means of a lever and cam system, the whole of which is covered by a large operating drum divided on its circumference into ten-minute intervals; the scale makes almost two complete circuits of the circumference of the drum, the latter having internal stops to prevent straining of the working parts.

Thus, in observing the altitude of the sun, the observer looks downward through the index glass at an angle of 45° with the vertical and sees the bubble illuminated by the light from the horizon in front of him; he also sees the horizon which, owing to depression due to altitude, will be below the bubble; after interposing the shades suitably he turns the operating drum while facing the direction of the sun until he sees the reflection of the sun from the index glass enter the field of view and then brings it to the center of the bubble. He next adjusts the size of the bubble till it is only just larger than the sun and makes his final setting for coincidence of centers. The reading is made on the circumference of the drum against a cursor carrying the index mark.

The drum is divided into ten-minute intervals, the scale making two circuits of the drum. The observer really has two scales separated by a central index mark on the cursor, the scales ranging from (—) 3° to (+) 39° and from (+) 39° to (+) 80°. When turning the drum from below 39° to above 39° and vice versa he feels a slight resistance which tells him that he should read on the other scale.

It will be readily seen when the observer only gets an occasional chance at a snap observation of the sun, that he can take the altitude of the sun above the apparent horizon and then determine the depression of the horizon by means of the bubble. Owing to the constantly changing accelerations of the aircraft, no single bubble observation can be relied on, because an acceleration of the aircraft deflects the bubble from its proper position; consequently the mean of several observations should always be used and the resulting accuracy is always greater than appears probable from a study of the differences of the individual observations of the series. This does not of course apply to the snap observation of the sun referred to the natural horizon.

Returning to the instrument description, it will be remembered that the beam of light after passing the second lens was not only transmitted through the index glass but was also partly reflected from it. Just as the transmitted portion combined with the image of the observed object reflected from the index glass, so the reflected portion combines with rays from the object that are transmitted through the index glass.

Thus if the drum is set to the altitude of a star and the sextant raised till the star is seen directly through the index glass, then the reflected image of the illuminated bubble (lamp in action) will also be seen and coincidence of centers can be obtained by adjusting the drum as before. The amount of light given by the lamp is controlled by a rheostat conveniently mounted in the handle.

A second lamp controlled by a switch is fitted for reading the drum scale and this can be moved over to illuminate a celluloid writing pad mounted on the flat of the drum.

The electric lamps are connected to any two-volt source of supply by a plug and flexible lead.

As regards the accuracy obtained in actual use a table is appended showing the results obtained by the Marquis de Pinedo and his fellow aviators both on the ground and when flying (for test purposes) over the Italian lakes, the actual position in the latter case being obtained by compass cross bearings. The sextant described is not the Bureau of Standards sextant and has stood the test of actual service several years.

The second instrument to be considered in these notes is the A.M.L. (Air Ministry Laboratory) Position Line Slide Rule invented by Captain Bygrave of the British Royal Air Force.

The slide rule is 9 inches high and 2½ inches in diameter and weighs less than two pounds complete with case. Two scales are printed on two cylinders sliding one within the other. The outer cylinder carries a spiral scale of log cosines and the inner a similar scale of log tangents, the latter being about 24 feet long. It is divided into minutes of arc throughout its length and the smallest degree division occurring at the middle of

RESULTS OF OBSERVATIONS MADE BY MARQUIS DE PINEDO AND OTHERS USING Mk. V. R. A. E. SEXTANT.

A. Sextant No. 1. (on the ground)

Date		*Object*	*Observer*	*Error* +towards object −away	*Notes*
15/6/26	morn	sun	Del Prete	+4′, 2	strong wind
"	aft.	"	De Pinedo	+1, 3	
16/6/26	morn	"	Del Prete	+0, 9	
"	"	"	De Pinedo	+0, 2	
17/6/26	"	"	"	+0, 5	
19/6/26	"	"	"	+0, 5	
"	"	"	Del Prete	+2, 7	
"	"	"	De Pinedo	+3, 6	
"	aft.	"	Conti	−0, 9	
"	"	"	"	−0, 8	
26/6/26	night	star	Viansino	+2	10 heights
"	"	"	De Pinedo	−4′	
"	"	"	"	−1′	
"	"	moon	"	0′	
27/6/26	"	Arcturus	Viansino	−0, 5	5 "
"	"	Antares	Conti	0′	3 "

Sextant No. 2 (on the ground)

29/7/26	16 h	sun	Del Prete	−4′	
"	16 30	"	"	−1, 8	
30/7/26	13 h	"	De Pinedo	+4′	
"	14	"	Del Prete	−3′	
31/7/26	9 h	"	"	−2′	5 heights
"	14	"	De Pinedo	+1′	10 "
"	14	"	"	+1, 5	10 "
"	18	"	Viansino	+2′	10 "
1/8/26	10 h	"	"	−3′	5 "
"	10 h	"	"	0′	5 "
2/8/26	17 h	"	"	+2′	5 "
"	17 h	"	Del Prete	+1, 5	5 "
3/8/26	11 30	"	Viansino	+0, 9	10 "
"	20 30	Arcturus	Del Prete	+6, 5′	5 "
"	22 40	Jupiter	"	+3′	5 "
"	"	"	"	+2, 2	5 "
4/8/26	14 h	sun	"	−3′	5 "
"	14	"	Viansino	+1, 5	5 "
5/8/26	14 30	"	"	+1, 5	5 "
"	14 30	"	Del Prete	−1′	5 "
"	14 30	"	"	−4, 5	10 "
6/8/26	11	"	Viansino	0′	5 "
"	13	"	Del Prete	+1′	5 "
8/8/26	12 45	"	"	0′	5 "
"	13	"	"	−3′	5 "
"	13	"	Viansino	+1, 2	5 "

B. Sextant No. 1. (flying)

19/6/26	aft.	sun	Viansino	−7′	10 heights
20/6/26	morn.	"	"	+0, 5	10 "
"	"	"	"	−1, 5	10 "
"	"	"	De Pinedo	−1, 5	5 "
12/7/26	"	"	Viansino	−2′	3 "
18/7/26	"	"	"	+2′, 5	3 "
"	"	"	"	+5′	5 "
"	"	"	"	−2′, 8	5 "
"	"	"	"	+5′	5 "
"	"	"	"	−4, 5	3 "

the scale is over an inch in length. The theory has already been published in *The Engineer*, issued in London on March 3, 1922. An extra outer cylinder carries two index pointers and also a condensed set of directions for use.

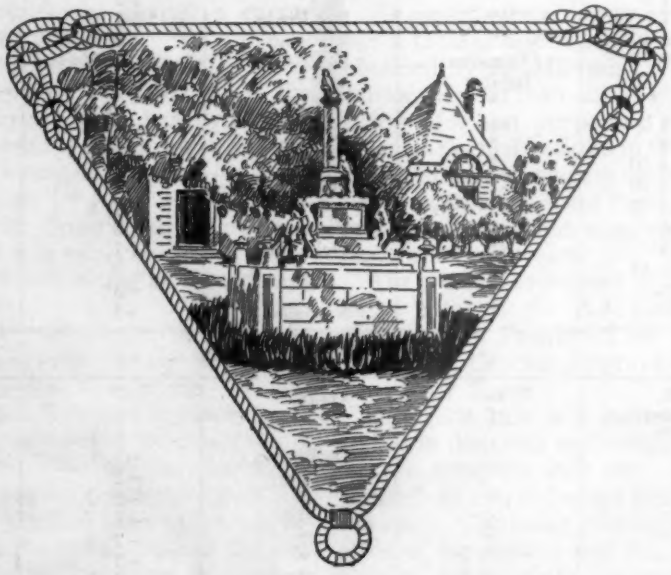
The method adopted utilizes as data an assumed position in latitude and longitude, as found from the dead reckoning, and the astronomical coördinates of the celestial object, right ascension and declination. From these and his chronometer, the navigator computes the hour angle of the object observed in a few moments and then turns to his slide rule. This he uses for three operations, first to obtain an auxiliary angle which he at once combines with the colatitude, adding it to the colatitude if the declination and latitude are of the same name, and subtracting if of opposite name. The next operation gives him the azimuth of the object observed and the third operation the computed altitude.

Now by putting his assumed position on the chart, he can at once draw his azimuth line and mark off his intercept which is equal to the difference between the observed and computed altitudes and then by drawing a line at right angles to the azimuth line, he has the position line upon which he was when the observation was made.

The whole of the slide-rule calculation can be easily performed in two minutes by a trained man and the accuracy is about one minute of arc which is as good as the average sextant operation.

Although the method is a little slower than the special star charts described in Lieutenant Commander Weems's article, yet it is very quick and of universal application. The observer will have only one method of reduction to use by day or night and is not restricted to those stars for which the charts have been computed. He also will not have to carry such a mass of charts as is required by the star chart method. Further the method has been proved by use over several years.

The instrument also lends itself to independent checking of the slide-rule work by repeating the calculation with the slide rule, interchanging the declination and latitude when, although a different (meaningless) azimuth will be found, the altitude finally found will correspond to that first calculated.



IF A MODERN "LEXINGTON," WHY AN OBSOLETE "PATOKA"?

By Lieutenant W. S. G. Davis, U. S. Navy

THE participation of the U. S. S. *Los Angeles* in the recent maneuvers in the waters of Panama awakened interest in lighter-than-air craft throughout the personnel of the fleet as nothing else could have done. For those in the defending force real interest was kindled first by her remarkable hops from the hangar at Lakehurst to her mobile base at the *Patoka's* mast with only the briefest stay at Guantanamo. In almost the same time that they required to proceed from Guantanamo to Colon, the great airship jumped from far astern to far ahead —to the actual theater of operations.

Here was news which bumped a good many messroom conjectures concerning the *Los Angeles* into the proverbial cocked hat. Treaty provisions had forbidden her earlier use for any military purpose. She was now to be given an opportunity to demonstrate her possibilities of practical use with the fleet and her sudden presence there awaiting the further orders of the fleet commander started a haphazard discussion of this untried arm which should, if sifted to logical conclusion, benefit the service greatly.

In the minds of the average line officers to whom the *Los Angeles* had heretofore been merely the "flying sausage," new questions were forming. In general, the original "wonder if that big cigar will actually make it down there" was rapidly giving way to "wonder if she will prove of real use to her fleet commander." And with that came wonder of what her "real use" might be. What is the proper tactical use of such a craft? What are her possibilities and limitations? What, in short, are her problems?

Many officers of high and low rank and many officials went out to get a close-up view of the *Los Angeles* as she lay at the *Patoka's* mast in Panama Bay. Some took short daylight hops in her. Some were enthusiastic about this "Queen of the Skies"—and some were not. But real interest was being taken and serious consideration given for the first time by the fleet as a whole to the lighter-than-air arm as a fleet unit. How many, even among those interested enough to climb the mast and board the airship, thought of the adequacy or inadequacy of her tender?

There must have been—somewhere in the background —the realization that the presence of an aircraft in the theater of operations was dependent upon the availability of her mobile base. But how many paused to consider the advance preparations necessary to have the *Patoka* there and whether or not this peculiar floating mooring mast was able to carry out her part of the job efficiently? To many ships and officers, the *Patoka* was a familiar sight—as a tanker; to some this strange hybrid was a novelty. Few considered that the use of the *Los Angeles* in this fleet problem was a test of the practicability of the mobile base as well as of the airship.

It is generally conceded that the *Los Angeles* more than justified the many years of ceaseless experimentation, development, and training in lighter-than-air craft. The giant *Akron* is nearing completion and it is to be hoped that the *ZRS-5* will soon be started. These new ships are built as military units and will be expected to be capable of operating with the fleet. In order to do so, they must have a mobile base and it would seem that it is high time to consider the essential features of a new vessel for this purpose.

During the long years in which the use of the *Los Angeles* was confined to non-military purposes, a startlingly small percentage of her flights have included her mobile base. The serious thought of designers coupled with valuable experience in operation has insured development and progress which are about to bear fruit in the largest and greatest airship yet built. What of the development and improvement of the mobile base? The *Patoka* has been of great value and, as a base for training flights, has fulfilled her

mission successfully. But to one taking part in the recent maneuvers on board this less active but essential part of the lighter-than-air unit, certain features of inadequacy are self-evident and cry out for remedial action in future design. Let us consider the problem from the viewpoint of the tender.

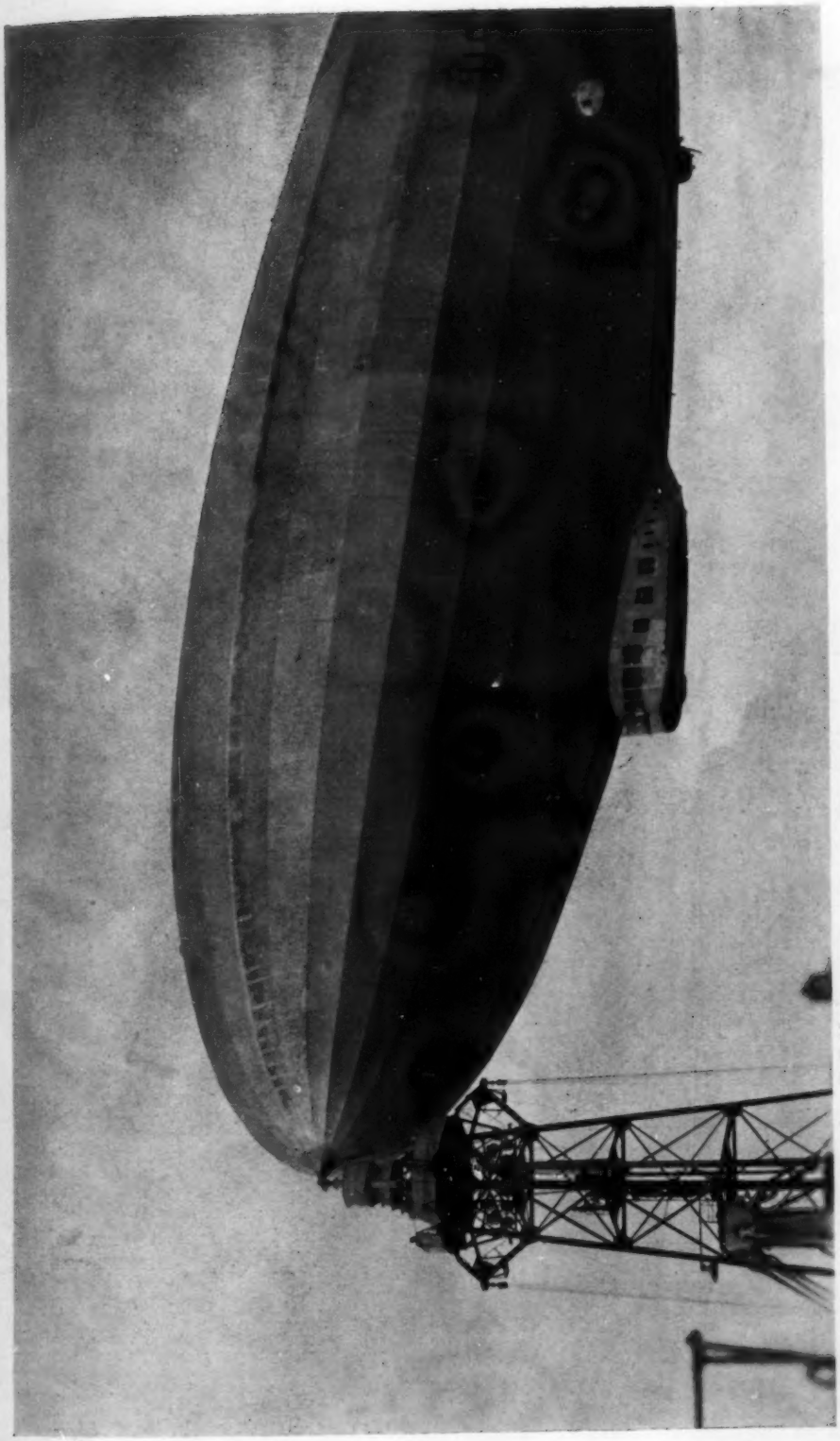
Upon receipt of word that the *Los Angeles* is to take part in the war game, the *Patoka* must undergo a metamorphosis from tanker to mobile base. Her mast and the necessary equipment for actual mooring operations are on board as permanent fixtures, but much is to be done. A shipment of helium must be obtained and loaded on board. Several thousand cylinders of compressed gas are lowered into a tank reserved for this purpose and manifolds connected. Next a tremendous supply of aviation gasoline is hoisted aboard in drums and stowed in other tanks—with a lapse of ten days to get this 10-knot ship from port to port. Spare engine parts and other equipment are obtained at still another port. A two weeks' period is necessary for boiler cleaning prior to departure for the south. Eventually all is in readiness and the ship lumbers along at pitiful speed to her assigned area, weeks in advance of the contemplated arrival of the airship. Immediately upon mooring the cry is raised for water ballast to replace the weight of expended fuel and to avoid valving precious gas. By this time the inadequacy of the tender's water storage space is evident and the tanks must be refilled. Now we have serious conferences between airship and tender. It takes time to obtain water from a dock and the airship must have swinging room for her stern, not possible at a dock. It takes time to strike up the drums and empty them into small deck tanks from which the gasoline is pumped up the mast and into the airship. There are no means of hoisting a spare engine up to replace a faulty one. And, above all, it takes time for the mobile base to steam to her rendezvous where she will enable the airship to utilize her cruising radius. Add to this the fact that the tender is dependent upon one solitary gun for her protection against encounter with hostile craft and you have an imperfect but growing picture of her inadequacy to perform her task and make that of the airship possible.

It is an incongruous fact that the United States, a nation which has fostered development in aircraft as a whole and is proud of her place in the aëronautical world, is today without a sea-borne aircraft tender that was designed and built from the keel up for that purpose. The *Wright* was converted into a tender of sorts but has no flying deck, the *Langley* was altered to include this essential feature, and results of experiments with these two craft plus the loss of our embryo battle cruisers developed the *Lexington* and *Saratoga*. There is under consideration the construction of a new type, the flying-deck cruiser—another compromise. The need of utilizing the knowledge gained through operations of the *Patoka* is upon us. Further alteration of this half-way tender is necessary to make her suitable as a mobile base for the newer, larger airships. There should be one available on each coast. Are we to hamper the movements and limit the efficiency of our modern dirigibles by shortsightedness in the matter of mobile bases for them?

It is for those charged with design to produce such a ship as will provide a definite negative in answer to this question. It is for those who have knowledge of our present inadequacy to indicate the major corrections necessary. The recent maneuvers brought out some important points. There are doubtless many more. The purpose of this article is to throw wide the door to discussion in order to furnish a basis on which to build the continued development of the floating portion of a new and useful naval arm.

Destructive criticism is ever abhorrent and, to start the ball rolling, it is suggested that the new type approach the proposed flying-deck cruiser in major essentials. She should be fast, armed sufficiently to withstand attack by submarines and destroyers, and carry a squadron of fighting planes for protection in the air. She should have adequate storage and equipment for making large quantities of fresh water. She should have special gasoline and helium tanks for carrying fuel and gas in bulk. She should carry spare engines and equipment for the airships and their attendant planes. She should, in short, be capable of offering her airships maximum service with minimum hindrance.

With this sketchy outline we will leave the modern mobile base for airships to the tender mercies of the design sections of the various bureaus. May she be speeded on her way!



RIDING COMFORTABLY
The cone-and-cap attachment and the openings in the hull may be seen.

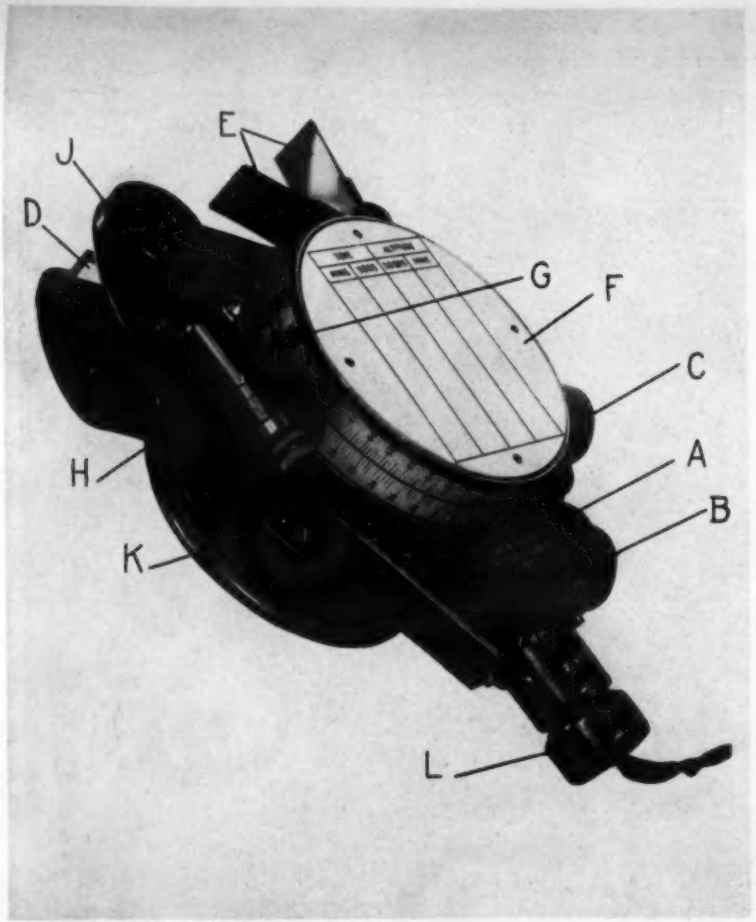
Photograph by Lieutenant C. W. Van Horn, U. S. Navy

Photograph by Lieutenant C. W. Van Horn, U. S. Navy

THE GANGWAY
The searchlights are for use with night landings.

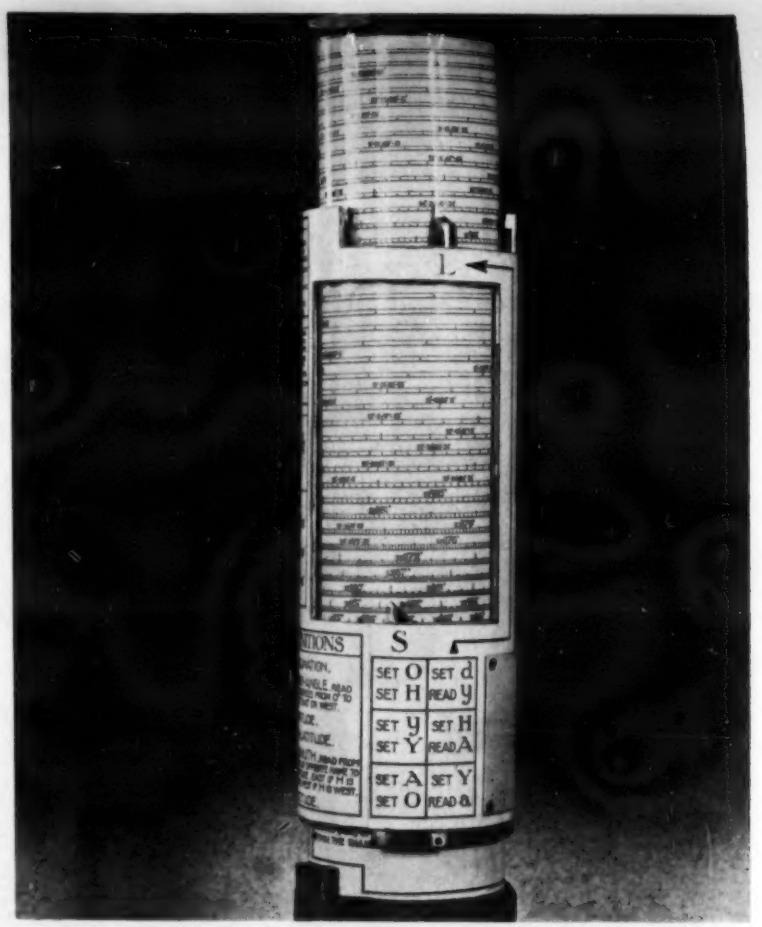
Photograph by Lieutenant C. W. Van Horn, U. S. Navy

THE GANGWAY
The searchlights are for use with night landings.



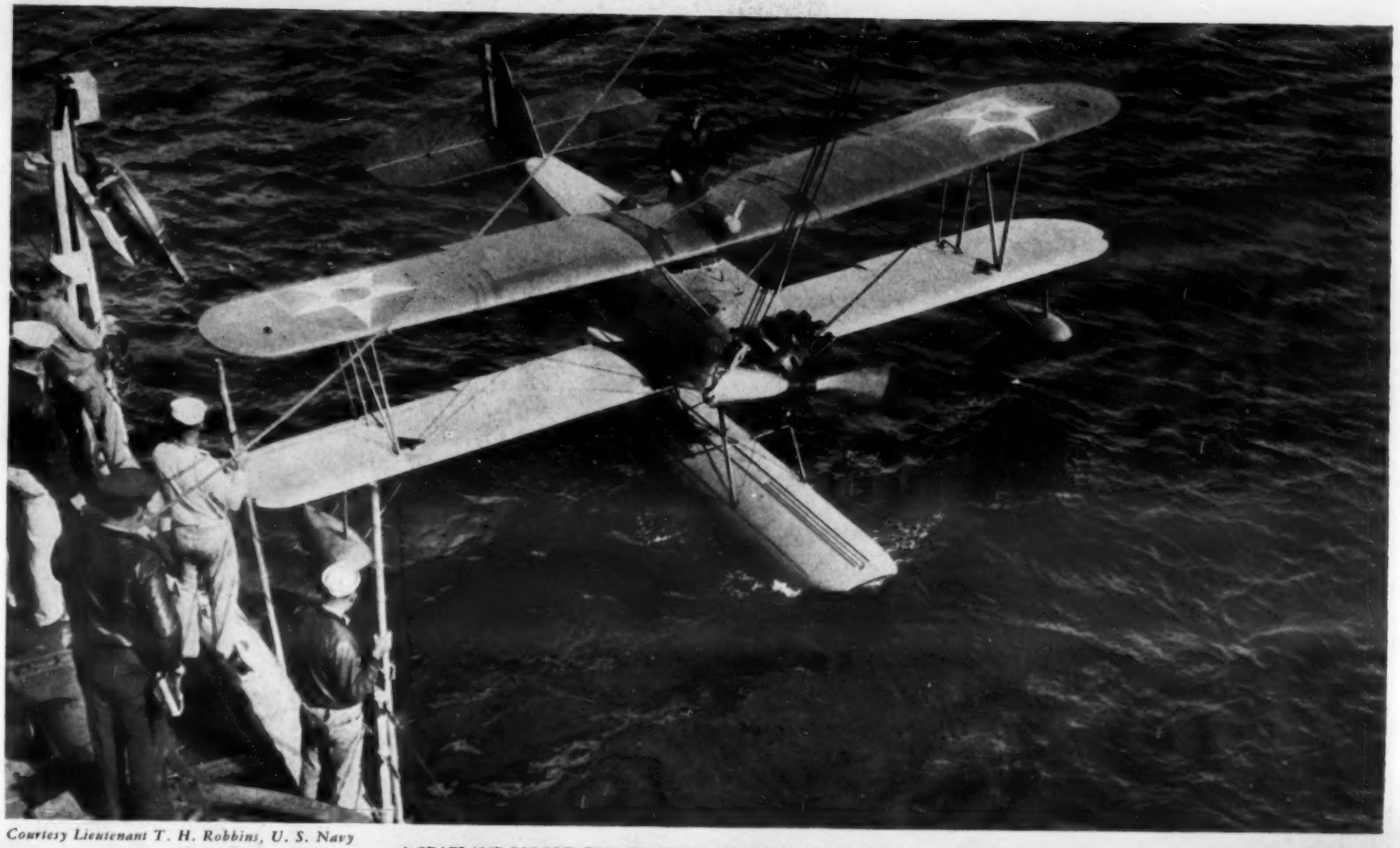
Courtesy Henry Hughes & Son, Ltd.

THE R.A.E. SEXTANT MARK V
A and B—bubble adjusting nuts
C—first lens
D—index glass
E—shade glasses



A.M.L. POSITION SLIDE RULE

(See article "Notes on Aërial Navigation.")

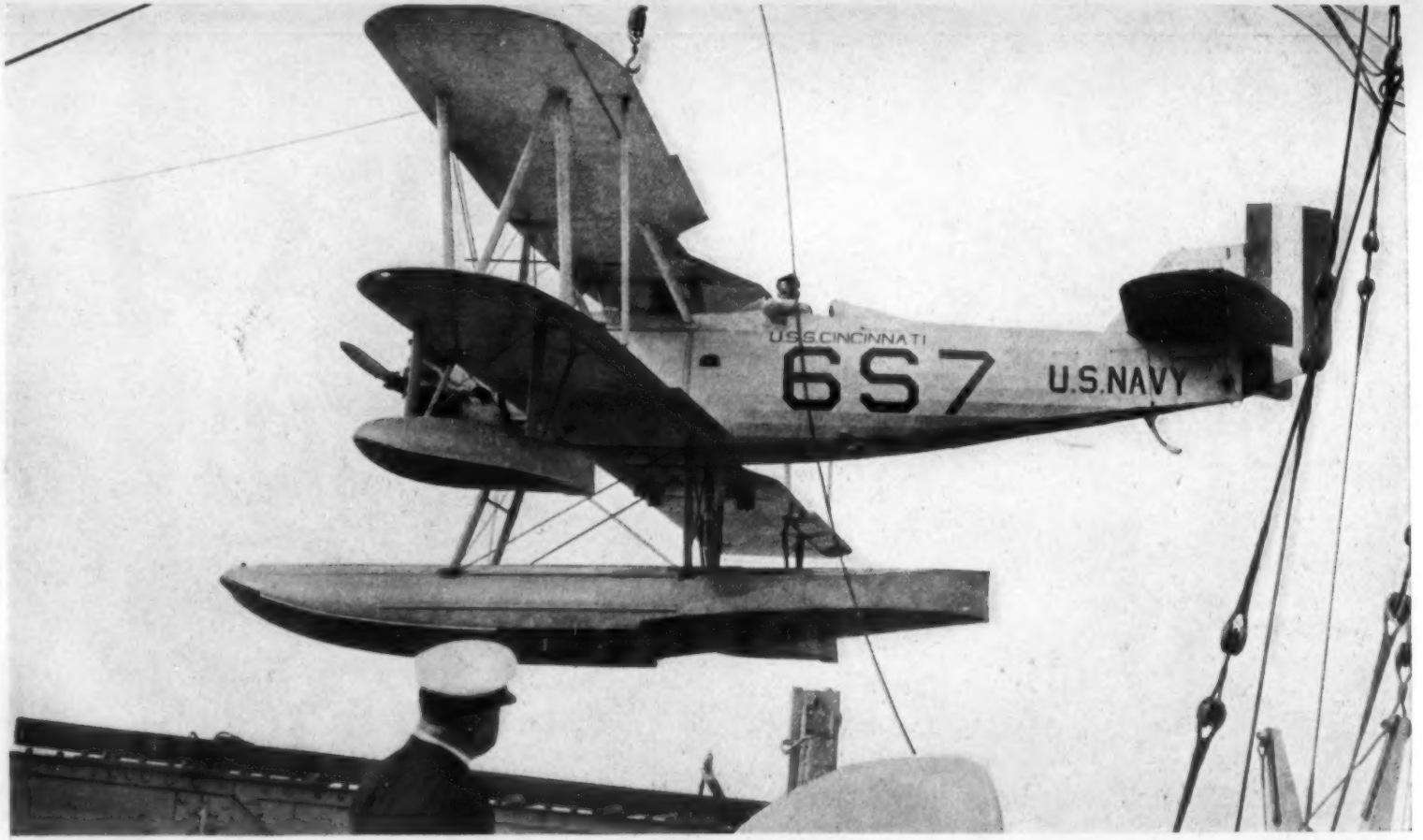


Courtesy Lieutenant T. H. Robbins, U. S. Navy

A SEAPLANE RIGGED FOR HOISTING IN ON BOARD A LIGHT CRUISER

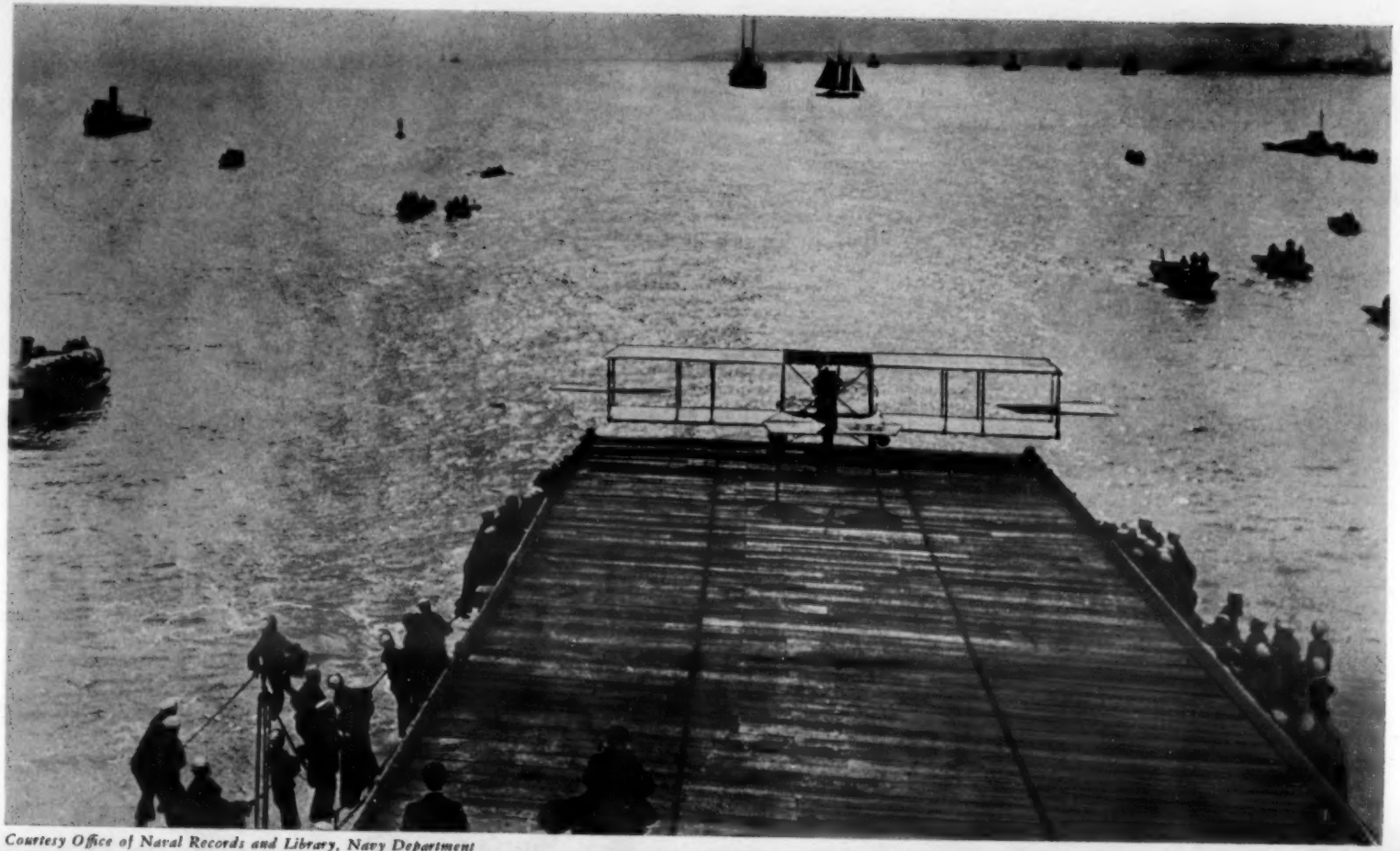
Courtesy Lieutenant T. H. Robbins, U. S. Navy

A SEAPLANE RIGGED FOR HOISTING IN ON BOARD A LIGHT CRUISER



Courtesy Lieutenant T. H. Robbins, U. S. Navy

THE PLANE COMING IN TO THE CRADLE

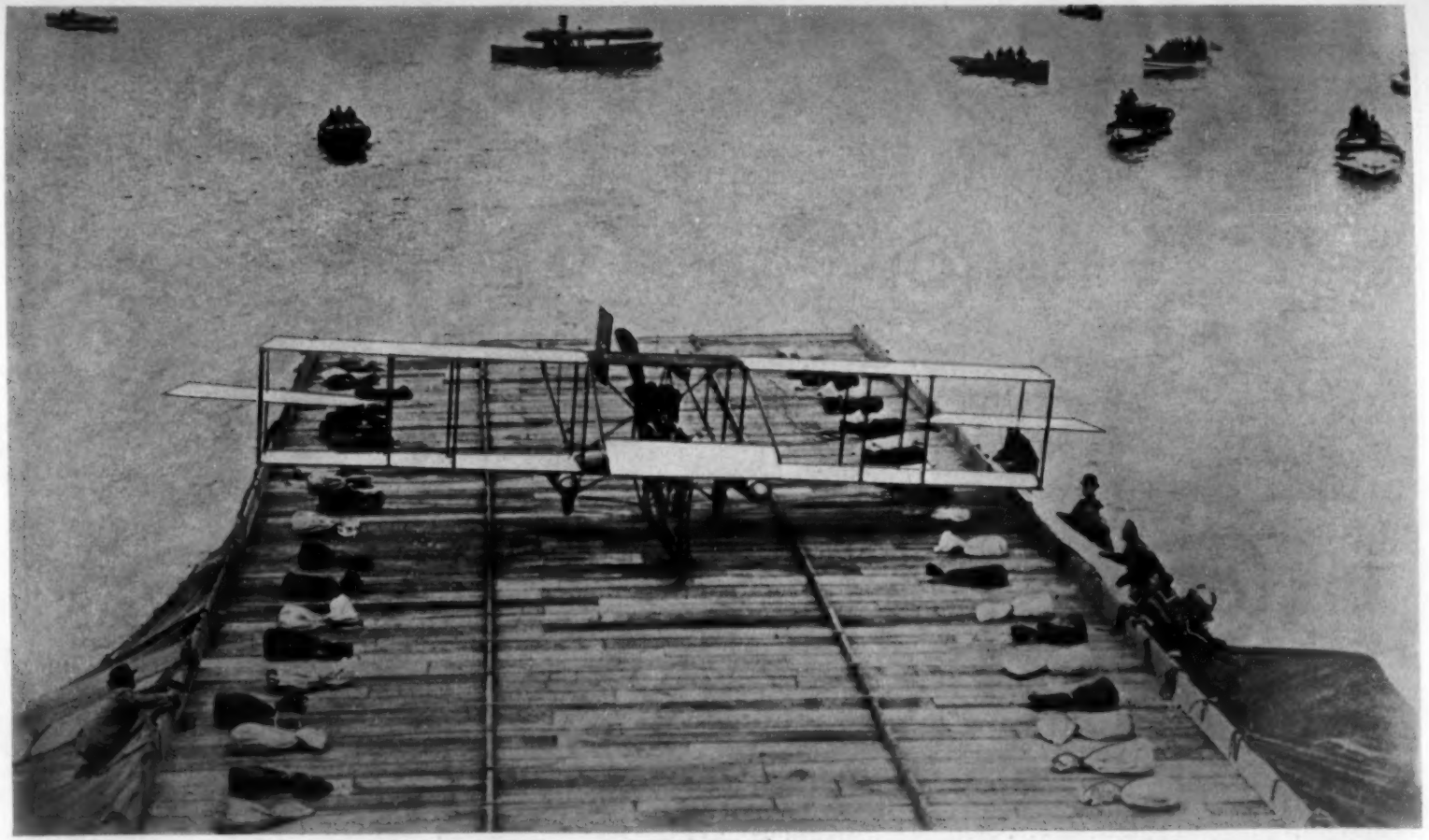


Courtesy Office of Naval Records and Library, Navy Department

ELY LEAVING THE ARMORED CRUISER *PENNSYLVANIA*, SAN FRANCISCO, JANUARY, 1911

Courtesy Office of Naval Records and Library, Navy Department

ELY LEAVING THE ARMORED CRUISER *PENNSYLVANIA*, SAN FRANCISCO, JANUARY, 1911



Courtesy Office of Naval Records and Library, Navy Department

ELY LANDING ON THE ARMORED CRUISER *PENNSYLVANIA*, JANUARY, 1911

Official Photograph U. S. Navy (Courtesy of Bureau of Aeronautics.)

INVERTED FLIGHT

INVERTED FLIGHT

Official Photograph U. S. Navy (Courtesy of Bureau of Aeronautics.)

THE LONDON TREATY AND AMERICAN NAVAL POLICY

By Captain D. W. Knox, U. S. Navy (Retired)

It is essential that we maintain the relative naval strength of the United States.—Charles Evans Hughes.

NOT since the war has there been such widespread, continuous, and serious attention to naval matters in the United States, as during the twelve months which elapsed between the preliminary negotiations leading to the London Naval Treaty and the final ratification of the treaty by the Senate.

This period marked an active renewal of the pacifist movement through strongly intrenched societies and various organs of publicity toward curtailment of American armaments regardless of equity. Their general line of argument was that armaments are a prime cause of war, and that the United States should vigorously promote world peace by ensuring the success of limitation conferences, even to the extent of sacrificing American interests if necessary. This is a reflex of the idealism so strongly imbedded in the American fiber, which apparently had been whetted by the failure of the Geneva conference of 1927.

Perhaps of greater significance was the nature of the opposition. The ranks of the national defense "die-hards," always in a great minority in the United States during periods of profound peace, had grown abnormally thin from the obvious improbability of an early war, and from aëronautical and other developments tending to lessen the value of naval effort close to shore. On the other hand, there was surprisingly strong adherence by a large section of the press to the doctrine of a navy for trade protection, and the corollary of American sea power proportional to American ocean commerce.

This represents a radical change of attitude towards the Navy, for which an awakening foreign trade consciousness, following the rapid expansion of over-seas commerce since 1922, is principally responsible. Previously the security of the country against invasion from seaward, and the protection of coastal cities against bombardment, had grown to become generally accepted as the major naval functions. The rather widespread realization of the value of a navy for the protection of a great trade upon which the general prosperity and economic life of the country depends, is an unexpected outcome of the year of public discussion of naval topics. It seems certain to have a profound effect upon American naval policy in the future.

Basis of treaty support.—A large section of the American public, including many naval officers, favored the London treaty for the sake of certain advantages, notwithstanding the alleged inequities respecting trade protection and other features.

The extension of naval limitation to include all classes of combatant types of ships met with virtually unanimous approval, even though such limitation was applicable only to the three leading navies. The belief was widely held that this should have a tranquilizing effect upon the entire world, and further that it would protect the United States against dropping too far behind other naval powers through unrestricted building by them on a scale which America might dislike to match.

Concerning the latter point there had been a disturbing disillusionment following the Washington conference of 1922. There the United States had led the way in sacrifices in the belief that it had succeeded in eliminating competition. Reference to the official report of the American delegation at Washington shows that their whole position was predicated upon the assumption that

> the core of the difficulty is to be found in the competition in naval programs, and that, in order ap-

propriately to limit naval armament, competition in its production must be abandoned. . . . One program inevitably leads to another, and if competition continues its regulation is impracticable. There is only one adequate way out and that is to end it now. . . . The effort to escape sacrifices is futile. We must face them or yield our purpose.

It is also clear that no one of the naval powers should be expected to make these sacrifices alone. The only hope of limitation of naval armaments is by agreement among the nations concerned, and this agreement should be entirely fair and reasonable in the extent of the sacrifices required of each of the powers.

This is the state of mind with which the American delegates entered the conference of 1922 and which persuaded them to concede more than any other delegation for the sake of gaining an agreement to stop naval competitive building. Their belief in such a result is clearly evidenced by the closing remarks of their official report on the naval treaty, where it is set forth that

The treaty absolutely stops the race in competition in naval armaments . . . it is far from probable that the absence of limitation, in the other field (i.e. auxiliaries) will lead to production of either auxiliary craft or submarines in excess of their normal relation to capital ships. . . . The limitation of capital ships, in itself, substantially meets the existing need, and its indirect effect will be to stop the inordinate production of any sort of naval craft.

That these deductions from the Washington naval treaty soon proved to be grossly erroneous needs no elaboration here. Notwithstanding a marked American deficiency of cruisers the spirit of the treaty as interpreted by our delegation prevailed against new programs for their construction in the United States, even in the face of large auxiliary programs quickly undertaken abroad. This developed an uncomfortable dilemma for America. Reluctant to enter into a new competition which would invalidate the supposed principal result so recently achieved at the Washington conference, she found herself rapidly losing her relative standing among the naval powers.

To solve this difficulty President Coolidge called the Geneva conference of 1927. When that failed he chose the only remaining alternative of an American cruiser program calculated to restore our relative naval position. There were great outcries both at home and abroad, that America was thus starting a new naval competition. However illogical these may have been they served still further to crystallize public opinion upon the need of stopping competition, and by 1929 there was virtually no division of opinion anywhere on this point.

Thus the elimination of naval competitive building became in America the universally accepted main object of the London treaty. When it had been accomplished at least temporarily among the three leading navies, it became the main factor in American approval of the treaty.

Those aligned against the treaty were as strongly in favor of the elimination of competition as anyone. Their objection centered about the contentions that America paid too heavy a price at the conference table, and that all signatories benefited equally by stopping competition and hence the mutual concessions should have been more equitable. If we are to gain any appreciation of probable future American naval policies it is necessary to examine into at least the most important of the various objections which have been advanced against the treaty. The point of view and principles which they represent are so fundamental as to give assurance of their growing influence, and now that the admitted advantages of the treaty have been achieved, our analysis may be removed from the realm of controversy and criticism, and be confined to the constructive object of research and deduction for future benefit. What follows is presented in that light.

The ratio of relative strength.—A main objection to the London treaty, admitted even by its proponents, is the lowered relative strength of the United States as compared with the theoretical 5:5:3 ratio in tonnage established at the Washington conference. Assuming that the provisions of the treaty are complied with normally, the total tonnage ratios for the three navies will become 5 for the United States, 5.2 for Great Britain and 3.25 for Japan.

The comparatively large elevation of the Japanese ratio has been especially criticized on the ground that it appears to have no rational basis. That the 5:5:3 proportion was very liberal to Japan on any reasonable set of assumptions, is evident from the conclusion officially reached at Washington in 1922 that the relative security of the powers remained unimpaired. The Japanese delegation assented to the ratio on this assumption after restrictive agreements had been made regarding the increase of fortifications and naval bases in the western Pacific

Ocean. There appears to be less reason for elevating Japan's ratio when we take into account her comparatively small size, population, wealth, over-seas commerce, etc., and the ease of protection of her main trade routes.

In the discussions and debates on the London treaty by the American Senate, the proponents laid great stress upon the very embarrassing situation confronting the American delegates by the relatively low standing of the United States in cruiser strength when the conference met. The *status quo* in cruisers of Great Britain and Japan was said to have given those countries a great diplomatic advantage, which rendered it necessary for the American delegation to make concessions respecting the ratio in order to reach an agreement.

The critics of the treaty stoutly maintained that the 5:5:3 ratio should not ethically have been subject to modification at London, because of the clear recognition and acceptance of its essential fairness at Washington in 1922; and also because it was then virtually agreed to be applicable not only to capital ships and airplane carriers but also to auxiliary craft and navies as a whole. They argued that such an American understanding in 1922 is shown by the subsequent statements of the American delegates and of President Harding, and by the fact that the United States agreed to forego her rights respecting development of naval bases in the Pacific, and to scrap her great preponderance in battleship power, down to a strength below Great Britain with no compensation other than the ratio. The willingness of the United States to make these sacrifices at Washington was advanced as proof of her understanding that the 5:5:3 ratio was in the future to apply to navies as a whole, since otherwise for her there would have been no need of a scrapping or naval base agreement, nor even any need of a conference.

Not until 1927 did the British attitude at the Washington conference towards naval auxiliary quotas become well understood in the United States. In his first speech accepting in principle the American proposal at Washington in 1922, Mr. Balfour had made some vague differentiation between auxiliaries which were normally a part of the battle fleet and those which were more directly concerned with trade protection. But at that time there was no clear appreciation in American circles of the really very sharp differentiation which Mr. Balfour intended, and which in its effects must very seriously impair the 5:5:3 ratio which in reality constituted the fundamental of the American proposal. Mr. Balfour clarified the British attitude in a speech in 1927, and more recently Mr. Winston Churchill has given even greater illumination by making public in Parliament one of the hitherto secret dispatches sent by the British Cabinet to Mr. Balfour during the 1922 conference. This dispatch was as follows:

> We welcome your decision to press for the total abolition of submarines. Even if you can obtain this, we wish to be consulted before a final decision is taken upon the limited scales of construction in small craft permitted to the various signatories. The position of Britain, with her world-wide possessions and food supplies, on the one hand clearly requires an entirely different standard from that acceptable by self-contained nations. We apprehend, however, that there is very little chance of the abolition of submarines being agreed upon, and in this event we must insist at all costs upon absolute freedom in regard to the character and number of all vessels under, say, 10,000 tons. We cannot, in the face of French freedom to construct a great submarine fleet, to say nothing of the submarine and cruiser construction of other powers, enter into any agreement fettering our liberty to build whatever numbers and classes of cruisers and antisubmarine craft we may consider necessary to the maintenance of national and imperial life. We feel sure, from our knowledge of your outlook on the whole problem, that you will share this view to the full. Even at the cost of a complete rupture, we feel certain you will not agree to any restriction in this sphere without previous consultation with the Cabinet.

The critics of the London treaty urged that had Americans understood in 1922 the full import of British reservations to the principles of limitation agreed to at Washington, there would then necessarily have been less sacrifice of American battleships and more insistence upon the 5:5:3 proportion applying to auxiliary tonnage in future agreements; that whatever may be the ethics of this question as between Britain and America when it comes to Japan there were no corresponding reservations in 1922; and that the American concession respecting naval bases was obviously for the purpose of establishing the ratio, then deemed to be fair and reasonable, with no subsequent change to alter such equity.

Regardless of ethics, however, recent opposition to the treaty in the United States

was based upon a belief that the American *status quo* in 1930 entitled her to more consideration in establishing future tonnage quotas for naval auxiliaries. The United States entered the conference with a very large surplus above the 5:5:3 ratio in destroyer tonnage. Of this some 63,000 tons, represented by sixty-one vessels, appears to have been counted out, even though under age, merely from having been placed on the disposal list a few months previously. It was argued that their status was thus parallel to the British disposal list of battleships in 1922, which then had to be counted in order to establish a near parity with the United States. But even excluding these sixty-one American destroyers the *status quo* ratio was 10 for the United States, 8.5 for Great Britain, and 5.5 for Japan, as compared with 10:10:7 in the final agreement. Similarly in submarines the United States entered the London conference with a substantially greater tonnage than either Britain or Japan, yet agreed to a new ratio of 10:10:10.

Granting all that can be said as to the deficient American 1930 *status quo* in cruisers, in the view of treaty critics that deficiency appeared to have been fairly balanced by her surplus of destroyers and submarines. In reaching a basis for future limitation a reasonable compromise might appear to have been, to have traded off as between excess cruiser tonnage on the one hand and excess destroyer and submarine tonnage on the other hand—retaining the 5:5:3 ratio in all three classes. Instead of this the United States was reduced below that ratio in every single class of auxiliaries—cruisers, destroyers, and submarines.

When the conference was called the United States had a large tonnage of obsolete cruisers, the scrapping of which had been held in abeyance until the completion of her new cruiser construction program. President Coolidge had made it very clear when this program was authorized that it was a "replacement" program, made especially necessary by large new cruiser programs having been previously started abroad, while America, in accordance with her interpretation of the spirit of the Washington treaty, had withheld new construction.

Considering the fact that one of the provisions of the London treaty is that the right of replacement is not lost by delay in laying down new ships, to the treaty critics it appeared that the same principle might have been recognized in computing the American cruiser *status quo*. Either the old obsolete tonnage might have been counted, or the replacement tonnage already authorized and appropriated for. Instead, both seem to have been eliminated from the calculation, and nothing counted except ships under twenty years of age actually built or building. A further argument advanced in support of counting the obsolete ships in the *status quo* was the fact that when the conference met there was no established and agreed upon age beyond which a cruiser could be said to be obsolete. Such an age limit could be fixed only by the conference itself.

If the American obsolete cruisers, or the tonnage already authorized to replace them, had been counted there would have been no deficiency in America's cruiser *status quo*. To have counted them would have been analogous to what was done with some British obsolete battleship tonnage at the Washington conference, and further would have offered some balance to various other concessions made by the United States in the treaty—such as delaying the construction of three American cruisers beyond the life of the treaty, advancing the replacement age for 172,000 tons of antiquated British cruisers, etc.

Since the *status quo* has been of such importance in establishing future ratios at all of the limitation of armaments conferences, there has been considerable concern in the United States over the cruiser *status quo* at the conference to be held in 1935, at which the attitude of the powers is not to be prejudiced by the terms of the London treaty. The question arises whether the cruiser allowances established at London are more likely to govern the 1935 agreement than the then existing cruiser *status quo*. It was argued in senatorial debate that if the latter is to receive the major consideration in 1935, then American interests are gravely jeopardized by the London treaty, because of the large amount of cruisers which will be under construction by Britain and Japan, by reason of the special provisions abnormally advancing the date of replacement for certain cruisers.

The general question of lowered American ratios was regarded with great uneasi-

ness in view of the striking sacrifices made at Washington to stabilize world peace, on the assumption that the 5:5:3 ratio was reasonably fair and permanent. After this to find the American relative position undermined at London, in consequence of our scruples against building between 1922 and 1928, together with the possibility of a further undermining in 1935, was greatly deplored, and this view seems bound to influence American naval policy in the future.

Trade protection power.—Perhaps the most serious opposition to the London treaty in the American Senate and press centered about the seemingly undue impairment of American trade protecting power, relative to the other countries participating in the agreement. For example in the case of Japan it was contended that she was left with virtually complete power to stop American trade to the value of two billion dollars annually, in the region from eastern Africa to China and Australia, inclusive, which is out of all proportion to Japanese trade which the United States might stop. It was similarly maintained that the treaty insured to Great Britain the ability to cut off all overseas trade of the United States except that to the Caribbean region and that with the west coast of the Americas. Under such circumstances it is obvious that the world-wide commerce of Britain would remain substantially unimpaired by any action within the power of the United States.

In discussing such questions it is not at all necessary to assume war between the countries with which comparisons have been drawn. The fundamental consideration is the relative trade protecting capacity of the United States, Great Britain, and Japan, in the regions of important world commercial markets, quite irrespective of what nation the trade may need protection against. Moreover international law has long recognized certain forms of trade interference as being measures short of war, among which may be classified the economic blockade so prominent in League of Nations literature. It would appear only equitable that the power to protect trade should be at least approximately proportional to the magnitude of the trade, whatever the nature of the menace against it, or from whatever quarter such menace may come. It was upon such general rather than specific grounds that this phase of the treaty met with objections.

The controversy in the Senate on this point was precipitated by the statements of several officials who had been attached to the American delegation at London, in testimony before the two Senate committees which held extensive hearings on the treaty. It was clearly brought out that the agreements entered into at London had been predicated by the American representatives exclusively upon considerations of fleet combat strength, and without any reference to American commerce protection ability. This seemed paradoxical in the face of expert testimony by one of the strong treaty proponents that fleet combat strength had been so nicely balanced through limitation at Washington and London, that no one fleet of the three powers concerned could make a transoceanic attack upon another without serious danger of defeat. The only logical conclusion to be drawn was that war between any two of the navies so limited must of necessity be almost exclusively commercial in nature, which is doubtless true.

Moreover there was criticism that the American delegation had thus given in to the fundamental British position so strongly held at Washington and Geneva. The misapprehensions as to Mr. Balfour's attitude in 1922, which were clarified several years afterwards, have already been explained herein. The same position was very lucidly propounded by Mr. Bridgeman and other British delegates at Geneva in 1927, and was really the basic reason for the failure of that conference. It has meantime been the subject of elaboration by Mr. Winston Churchill and many other British speakers and writers. It amounts to the doctrine that the special situation of Great Britain respecting food supplies and extended trade routes makes it necessary for her to have substantially greater trade protecting power than any other country, and renders it equitable that she should enjoy such superior advantages.

Many Americans felt that the London treaty went too far in this direction and thus conflicted with a wholesome American viewpoint, which in the long run should be better for the amicable relations between the two countries. Adherence to this American standpoint, as it has often done in the past, brought unwarranted imputations of want of sympathy and unfriendliness towards Great Britain, and even of aggressive and

warlike designs against her. To set forth this American attitude with some precision therefore seems to be important, if serious misunderstandings are to be avoided by its apparently persistent growth.

We have in the first place the very obvious fact that parity in navies between the two countries cannot mean equality of sea power. This follows from two conditions which are unlikely to change materially for a great many years. The wide dispersion of the British Empire, affording strong points of support to naval effort in every important region of the globe, amounts to a multiplication of the power of the British Navy. Reference is made not only to the many naval bases offering facilities for repairs, sources of supply, and security of refuge, but also to the great commonwealths and colonies ready to afford economic, military, and every complementary aid to naval strength. The second condition is the size and characteristics of the British merchant marine, representing an auxiliary to purely naval strength of immense importance.

With these two elements supplementing her Navy, Britain need have no fear that parity in navies with America threatens British naval supremacy. The truth of this is clearly recognized by those in America who have been contending for mere parity in navies with Britain, and should be sufficient to absolve them from the charge of aggressive intent. They maintain that while equal naval power cannot give America sea power even approximating equality with Great Britain, such a proportion of navies is the minimum which the extent of American over-seas interests, stable peace, and general equities demand.

The marked superiority which Britain enjoys on a basis of equality in navies becomes even more accentuated when it comes to a specific consideration of trade protection, apart from general fighting strength, especially remembering that the balance provided by naval limitation precludes the likelihood of combat between concentrated fleets.

To begin with there are three British battle cruisers, of such speed and power as to render them capable of a major rôle in commerce protection and commerce raiding. Except in the smoothest weather their speed should be at least equal to the 8-inch-gun category of treaty cruiser, which fact gives Great Britain a superiority in this category far exceeding assumptions as to treaty terms that might be made academically.

The relatively high speed of the five battleships of the *Queen Elizabeth* class also places them in a semicommerce protection class, because of the wide dispersion which may be safely made of them without danger of injury from a concentration of much slower opposing capital ships. Conversely they prevent a similar dispersion of slow opposing battleships for commerce protection or attack. Thus Britain enjoys the immense advantage of eight capital ships which to an important degree are accessories of cruiser warfare, whether conducted for the defense or the attack of trade.

The next cardinal factor entering into trade warfare that requires some detailed examination is the matter of naval bases. The fundamental effect of bases in multiplying the numbers of ships is not always understood or admitted. The principle involved may be made clear by an example. Let us compare the trade protecting power in the China Sea of the American, British, and Japanese 8-inch-gun cruiser quotas established by the treaty, assuming that the nearest bases available were respectively Honolulu, Singapore, and Nagasaki.

Since a 10,000-ton cruiser can steam about 15,000 miles each American cruiser would consume two-thirds of her fuel in going to and returning from the China Sea where she could consequently spend only one-third of her total time engaged in her trade protection mission. In comparison with this a British or Japanese cruiser, operating from Singapore or Nagasaki, could spend nearly four-fifths of her time protecting commerce in the China Sea. Their marked advantage over the American cruiser would be entirely due to the much greater proximity of their base to the operating ground.

Translated into terms of numbers of cruisers which can be kept employed in useful work, in order to keep four cruisers on station, the British or Japanese would need a total of five cruisers while the United States would require twelve. Hence in this case the five British or Japanese cruisers are a match for twelve American cruisers, and, for the sole reason of having near bases, the British or Japanese effective numbers have been multiplied by 2.5 as compared with American numbers. The relative strengths in 8-inch-gunners under the treaty, for this

particular example, thus in reality becomes eighteen for the United States, thirty-seven for Great Britain, and twenty-five for Japan.

Lest it be assumed that an extreme case has been chosen for the purpose of illustration, it may be stated that the same relationship applies as between American and British 8-inch-gun strength to the great trade region off Buenos Aires. Along every other vital British trade route, excepting that to Canada, her advantage incident to naval bases is even more pronounced, and to this trade warfare advantage should be added, not only the already mentioned battle cruisers and *Queen Elizabeths*, but also as a third major element, the great British preponderance of merchant ships suitable for use as naval combat auxiliaries.

The value of armed merchant ships as a substitute for cruisers in blockade and trade protection operations was amply demonstrated during the World War. While a single merchant ship may not be a match for one regular cruiser carrying the same armament, it is necessary to consider the question from the viewpoint of multiple numbers. Then it becomes evident that to equal the fighting power of a given force of merchant auxiliaries at least 50 per cent of their total number is required in regular cruisers.

Another aspect of the value of merchant auxiliaries in trade warfare is well illustrated by the recent remarks of Mr. Winston Churchill in Parliament. He assumes two navies "A" and "B," each of which possesses fifty cruisers. If "A" by sending ten of its cruisers to raid the trade routes of "B" can draw thirty cruisers of "B" to protect those trade routes, the resultant forces available for battle will not be equal. While he was not speaking of merchant auxiliaries the same principle is applicable to them. They are of great value in forcing hostile regular cruisers to desist from raiding and to devote themselves to the protection of their own trade.

The Navy possessing a great surplus of merchant auxiliaries could thus substantially reduce the menace to its trade, and this in turn would free many of its regular cruisers from trade protection duties and enable them also to be employed in raiding. In other words, comparing two equal forces of regular cruisers in trade warfare, if one of them is augmented by a great preponderance of merchant auxiliaries, it will be able to take the offensive and put the other cruiser force almost entirely on the defensive.

The foregoing comment is especially applicable if regular cruisers carry guns no larger than those which may be mounted on merchant ships, and in some quarters this has been assumed to be a principal reason for the apparently persistent British desire to limit other navies to the 6-inch-gun cruiser as far as practicable.

An eminent American authority has estimated that if all regular cruisers were of the 6-inch-gun type, a ton-for-ton and gun-for-gun parity in regular cruisers between the British and American navies would enable Britain to bring to bear four 6-inch guns to our one, in practically every important trade region in the world; taking into account Britain's advantages in both merchant ships and naval bases, but without considering naval units other than cruisers.

This furnishes one very obvious reason for the American desire for an unrestricted right to build 8-inch-gun cruisers within the fixed limits of individual size and total tonnage. Another reason is the availability of British capital ships, especially battle cruisers, for trade warfare, because 8-inch-gun cruisers are the closest approach to battle cruisers that it is possible for America to have under the present lull in capital ship construction.

This whole matter of trade protection is much broader than the technical details necessarily entering into it, the discussion of which has led to unwarranted implications that those who stand for adequate American commerce protecting power do not stand for peace. Rather is the reverse the fact if history carries any lesson.

Criticism of the London treaty centered on our impaired trade defense ability as much as any other question, and this seems to be of great significance in indicating the trend of our naval policy of the future. It shows a growing public appreciation of the basic function of a navy, its inherent relation to the prosperity and economic life of the country, and a return to the traditional American naval policy.

Propaganda and naval policy.—The day has gone by when it is possible to consider national policies, naval or otherwise, purely on the basis of facts and national interests. As each broad question comes under the lens of public attention the focus is almost in-

variably blurred by propaganda, and as our whole government machinery is peculiarly and critically sensitive to public opinion, the decision is often founded on distortion, misrepresentation, and fallacy.

There is nothing new in government by public opinion created through the press. Joseph Danvers complained of it in the House of Parliament as early as 1738. In the *History of Journalism in the United States,* Payne points out that "Before England knew of this power, this new authority, it was established in America."

Except for the freedom of the press and the public-spirited, militant journalism of Samuel Adams, Benjamin Franklin, and others, the American Revolution never could have been begun, much less sustained through six trying years. Meantime, says Payne, "The ideal of government by public opinion has been more nearly achieved in this country than elsewhere."

The development of this ideal has seen some extraordinary phases. President Washington's proclamation of neutrality in the war between England and France, brought forth a frank and direct appeal over his head to the American people by the French Minister Genet, through an American editor who was also an employee of the State Department. The President found it necessary to draft Alexander Hamilton to conduct a counter-propaganda before public opinion could be turned conclusively in favor of neutrality.

Students of American history are sufficiently informed of the virulent, inflammatory, abolitionist propaganda which continued for thirty years prior to the Civil War and made that war inevitable. An analogous movement with which the present generation is more familiar is that affecting prohibition laws.

The prelude to our entry into the World War furnished a classic in propaganda. Here on neutral soil the two combatant groups conducted a war of wits and words second in importance only to the action of their armed forces on the battle fronts. Until November, 1916, one group succeeded not only in keeping us "out of war" but also in contributing to the re-election of Woodrow Wilson through that fact. Five months later the other group had gained such complete ascendancy that we went into war with the acclaim of even most of our pulpits—some of the very pulpits, incidentally, which, now lead public opinion to discredit officers of the Army and Navy who were mute before April, 1917, but are now alleged to be breeders of war.

These few illustrations of propaganda in American history are but landmarks of a never ending influence of first magnitude in our national life, which amounts to an authority above the government and which has to be taken into account in any consideration of national policies. This may be a healthy sign of progress of the democratic ideal, so long as the propaganda is a wholesome effort from within the country. But those having the best interests of America at heart cannot avoid anxiety over the growing custom of unwarrantably emphasizing the foreign viewpoint through our free press and other organs which create public opinion.

Coincident with the greatly increased facility for reaching the public quickly there have sprung up numerous highly organized and openly avowed agencies of propaganda, which cover almost every field and embrace nearly every cause, social, political, economic, and religious. Doubtless most of them are sincere and wholesome in their aims and practices, but wittingly or unwittingly, they sometimes advocate measures very inequitable to the United States and markedly advantageous to foreign countries. This is especially striking when they embark upon naval seas too deep for their technical comprehension.

An example of propaganda unjust to American interests is that now in progress against the American merchant marine. We are represented as needlessly upsetting world business and provoking competition and ill feeling possibly leading to war, by building new merchant ships at a time when there is a world surplus of 6,000,000 tons of shipping. This is partly true, as is the case with most propaganda. The remainder of the truth is that the present merchant ship construction in American yards is considerably less than our needs for replacement of ships normally becoming obsolete; that in 1922 there was also a large world surplus of merchant tonnage; that between 1922 and 1928 foreign nations built 10,000,000 tons while we laid down practically nothing; and that they are even now building much more than we are.

An illustration may be chosen from the political field also. We have had our recent difficulties in Nicaragua, the Philippines, and Haiti. No great nation has ever been more altruistic in its dealings with weaker countries than we have been in these cases. Yet the most scathing criticism was meted out to us by the same organizations which have found well-merited justification and sympathy for Great Britain in her firm action in India, Palestine, Egypt, and elsewhere.

The professional reader will be too familiar with the frequent misrepresentation of naval affairs to the great detriment of the United States, and correspondingly to the advantage of other countries, to require the citation of many cases. However innocent this may be as a rule, unquestionably the effect has been a tendency to reduce America's relative naval strength well below her inherent interests, and beyond any reasonable assumptions as to the need of our self-sacrifice in order to promote world peace.

Sufficient reference has been made elsewhere to ways in which the public has been misled respecting the Washington conference. After the failure of the negotiations at Geneva in 1927, we had another example of propaganda at work in the attacks which were launched against "naval experts," who were openly accused of having blocked agreement for the sake of maintaining "big navies." Disregarding all fact and logic this propaganda became especially virulent in the United States against American naval officers, who were even held up to the ugly suspicion of having entered into collusion with shipbuilding interests.

It mattered not that the President, the Secretary of State, and the head of our delegation at Geneva were civilians who gave the most thorough personal attention to every aspect and development of the proceedings and made all of the decisions respecting them. It was of no import that the American naval officers there unanimously stood against a high level of limitation, and supported quotas closely approximating those subsequently adopted with such acclaim at London in 1930.

The paradox of accusing naval officers at Geneva of furthering the cause of a big navy and the pocketbooks of shipbuilders by standing for a low level of limitation has never been made clear. Nevertheless skilled propagandists succeeded so well in inoculating the American people, and even many of our higher officials, with the illogical idea, that between 1927 and 1930 the American naval officer was seriously discredited in his own country.

A final example may be taken from a release by the leader of a publicity agency which has been openly maintained for a number of years by a prominent group of American churches. The release to American papers was from London where the publicist was covering the late naval conference then in session. He was undignified and vituperative in denouncing the American position and almost as severe in criticising the French for having set their demands at 70 per cent of British strength. But when it came to discussing the British angles of the situation there was only justification and sympathy for them. This has been the general attitude of this publicist and many others for a number of years whenever naval topics were under discussion.

It is by such means that a true and clear understanding of the elements entering into a naval limitation conference and of the results which may be achieved by it become impossible for the American people.

Granting all that can be said as to the impropriety of naval officers attempting to dictate the naval policy of the country—an impropriety which no American naval officer will question—they nevertheless have an obviously important function in the formulation of such policies. Their professional knowledge and advice must necessarily be utilized by statesmen if the vital interests of the country are to be safeguarded at the conference table. Now that we seem to be in an era of periodic limitation conferences it is a matter of considerable national importance that the American public should be protected against the sophistry which would have them discount the advice of their own naval officers, while indirectly and unknowingly accepting foreign naval advice. The United States is dangerously close to that situation today. Indeed propaganda has reached such lengths since the late war in shaping our naval policy that it now has to be considered as one of the major factors affecting such policy. We can no longer count upon basic national interests finally asserting themselves in spite of long intervals of public indifference to naval questions, and notwithstanding the Navy's traditional

aloofness from public discussions. The formation of American opinion in such matters apparently has been actively and persistently pursued by interests out of sympathy with American maritime and naval development with the inevitable result that America and many of her civil officials have constantly held sincere opinions unknowingly founded on misrepresentation and half truths. Under such conditions what else could be expected than that America should innocently decide naval questions unfairly to herself?

There are many persons who make light of this situation on the ground that in the end truth will prevail. In one sense this is true. In the hands of skilled propagandists, however, the whole truth prevails only after it is too late to have a decisive influence on the issue.

Conclusion.—The forthcoming era of periodic limitation conferences will require of the Navy more than its traditional public aloofness if the best interests of the country are to be served. There is no need of launching forth into objectionable propaganda. But there is every reason for protecting the country against wholesale misrepresentation and half truth, for the exposure of which technical knowledge may be necessary.

We have for example at the present time foreign opinion constantly appearing in our press that the 8-inch-gun type of "treaty cruiser" is now "useless," with the implication that the United States would make a serious mistake to build up to her treaty quota in this type. There is the never ending propaganda that this country should set an example to the rest of the world by disproportionately reducing its armaments, together with misrepresentations as to our existing strength in comparison with other navies. In respect to our naval needs for commerce protection unsound arguments are often advanced to show that "our trade protects itself" or that shore-based aircraft offer sufficient protection to shipping.

For some years there has been a persistent propaganda with the apparent object of breaking down the American contention that we need a navy to safeguard our neutral rights when other countries are at war. Highly inaccurate statements have been broadcast that when the United States entered the World War she adopted the very practices respecting neutral shipping which she had so vigorously protested against when a neutral herself. The exact opposite is the fact, yet so successful has been the propaganda that even many naval officers have fallen victim to it. This, together with the illustrations given in the preceding paragraph, indicates the existing need of guarding the public against being imposed upon, innocently or otherwise, in publicity concerning naval affairs.

In the last analysis it is the American public which must decide upon their naval policy and this they cannot do intelligently without accurate and sufficiently comprehensive information. Hence we should recognize the value of the national service done by those who criticized parts of the London Naval Treaty. Regardless of the merits of their case they so focused public attention upon the treaty as to bring about a general understanding of its terms, and to formulate public conceptions of a rational naval policy for the future.

For the first time there seemed to be a really widespread appreciation of the one-sided sacrifices made by the United States in 1922, which even ardent London treaty proponents frankly admitted. They also deplored the necessity of lowering our ratio at London in order to gain an agreement carrying complete limitation in all classes of ships. In debate the two senatorial delegates expressed their conviction in the strongest terms that we should henceforth build up to the treaty limits, so as to avoid further sacrifices of the ratio on account of future deficiencies of *status quo*.

An unexpected development was the exhaustive discussions, both in the Senate and by the press, of the effect of the treaty upon our commerce protecting power as distinguished from fleet combat strength. This seemed to indicate a rapidly growing realization of the close relationship between national economics and naval power.

In all of this we see public opinion and naval policy in the making as a reflex of the London Naval Treaty. But the conceptions thus formed can scarcely survive until 1935 against the onslaughts of misrepresentation and half truth which have been typical since 1921, unless the Navy will do its legitimate part in safeguarding the whole truth.

NAVAL FIGHTING PLANES

By Lieutenant Commander F. W. Wead, U. S. Navy (Retired)

THE work of naval fighting planes is, in general, *offensive, defensive,* or *protective. Offensive patrols* are carried out in the area of the enemy fleet and include action against enemy aircraft of all types and particularly against the enemy defensive fighting patrols, and, by strafing against enemy surface craft. *Defensive patrols* are carried out in our own area to safeguard the fleet against attacks by enemy aircraft. *Protective patrols* accompany and protect our spotters, bombers, torpedo planes, and scouts against attack by enemy fighting planes.

Offensive patrols in general should operate as near their ceiling as is possible, over 20,000 feet, in order to use superior altitude in attacking enemy aircraft which may be sighted at or near ceiling or some thousands of feet lower. Pilots therefore require oxygen and fur-lined clothing. It should be noted, however, that in combat the fight rapidly works down to lower levels because of the tendency to gain speed by diving at all stages of combat. Offensive patrols may have a definite objective, such as the enemy carriers or enemy defensive patrols, or may merely be assigned to patrol and clear the air in the enemy area as a furtherance to subsequent operations of our torpedo planes, bombers, tactical scouts, or spotters.

Primary defensive patrols should be carried out at ceiling over our own area in order to have the advantage of superior altitude and thus be able to dive to an intercepting attack as enemy aircraft approach. It is also considered advisable by many who have studied the problem that a secondary defensive patrol be maintained at from 12,000 to 15,000 feet. This secondary patrol serves as a decoy for the primary patrol at ceiling; it should further have the function of protecting the fleet against observation by scouts or spotters and against torpedo planes, all of which normally operate below its level. This arrangement eliminates the withdrawal of the primary patrol from its superior position for long periods of time, as even our present single-seaters require some twenty-odd minutes to climb from sea level to ceiling, and enables the primary patrol to concentrate its attention on enemy bombers and fighting planes which customarily "come over" as high as possible. Also, under the more comfortable flying conditions that exist at 15,000 or 12,000 feet, a higher degree of alertness may be expected; such units can therefore probably avoid disastrous attack from above until the primary patrol has been attracted to the scene, and visibility as regards picking up enemy aircraft at lower altitudes is undoubtedly better than it is at or near the ceiling. The "stair-step" principle of patrols at different altitudes has always been excellent for defensive purposes. While lower layers are at a tactical disadvantage, this is more than offset by the opportunity for surprise attack afforded the upper layer. This arrangement also has offensive value provided that the upper layer is *numerically superior* to the enemy and defeat in detail is not risked.

Protective patrols (escort) must choose their position relative to the airplanes which they protect (convoy) with the following difficulties in mind: (a) If the patrol is very close to (say 2,000 feet above) its convoy it will invariably be attacked from the superior position, i. e., above, as the ceiling of the types of aircraft being convoyed is always much less than that of enemy fighters. Also by determined dives enemy fighters can almost always pierce the escort and attack the convoy before they can in turn be attacked by the escort. Such a close position, however, may enable the free guns of the convoy to assist the escort in defense. (b) If the escort patrols at a considerable altitude above the convoy it is not so likely to be attacked from the superior position. The difficulty of keeping touch with the convoy and in the best defensive position relative to it, however, is increased. Even large

formations a few thousand feet below have a disconcerting habit of turning under one's wing and then being picked up a few moments later as mere dots disappearing on the horizon. Further, with high protection there is always the possibility that enemy fighters may dive in from the side and reach the convoy before the escort can intercept them and attack. True, the escort will at once follow down to the attack and engage from a superior position. This, however, may be merely locking the barn door after the horse has disappeared.

It should be noted that the range and endurance of fighting planes is normally small compared with that of bombers, scouts, and torpedo planes. This has no tactical significance other than to limit the occasions on which the fighting-plane escorts are practicable. All fighting planes now in use in this country by our own squadrons and by the Army Air Corps are single-seaters. They represent the maximum which may be obtained in a service airplane in speed, climb, and maneuverability. They are, of course, fitted with two fixed guns synchronized to fire through the propeller, aimed by the pilot by pointing the airplane itself at the target.

When one single-seater dives from above to attack another single-seater the former has the advantage of speed, position, and often surprise. The latter must pull up, get his engine between himself and his opponent, endeavor to get out a short burst while hanging on his propeller, and must also turn towards his opponent in order to pull him over on his back (past the vertical) in his dive, so that accurate shooting and maneuverability become difficult because of the great speed which is almost instantaneously reached. The attacker therefore must soon pull out of his dive, the opponents then turn back towards each other and "chasing tails" results until one plane or the other gets a momentary advantage and a victory. It can be readily seen that single-seaters, fitted with fixed guns firing through the propeller, are defensively very inefficient against diving attacks from above. This is the direction from which *every* air attack originates. Fighting planes are powerless to attack aircraft above them, though they may, of course, be able to outclimb the latter, gain position because of superior speed, and subsequently *dive* to the attack.

Experience shows, however, that a single-seater diving against a free machine gun is at a distinct disadvantage. The free gunner has a steadier platform, with nothing to do but aim and fire his gun, and cross fire from planes in V formation has proved very effective in guarding blind spots on which self-contained guns cannot bear, as under the tail. For this reason spotters, bombers, etc., are invariably fitted with one or more free guns. Such equipment is not effective for self-defense simply because at the vital moment when a bombing attack is actually being carried out, or when spotters are actually engaged in spotting—and at these times enemy defensive efforts may be expected to be at a maximum—in many types of aircraft the free gunner has other paramount duties. Also, such airplanes have not the requisite maneuverability and performance to give their free gunners necessary assistance by maneuvering to protect themselves as completely as might be possible from determined single-seater attacks. Such arrangements are admittedly unsatisfactory and have been made simply as the best defensive step possible with existing types of planes, in which other requirements than defense are usually paramount. Fixed guns firing forward through the propeller are rarely installed on large planes such as bombers because they are so unwieldly that aiming the gun by pointing the airplane is nearly impossible. Hence single-seaters usually attack such types from ahead and on about the same level, where the free gun is blanketed by the upper wing. Single-seaters also customarily maneuver around such types out of range and dive in on blind spots unopposed whenever the opportunity offers.

The indication is that the two-seater fighter is a badly needed intermediary type, primarily for protective use.

With the same power plant and ingenuity of design the single-seater fighter will always be slightly superior to the two-seater fighter in maneuverability and performance. The latter must have a slightly larger fuselage, must carry a gunner, a free gun, and ammunition for it. To offset this difference in performance the two-seater fighter has a free gun which effectively guards it against single-seaters *diving* to attack (the universal method) from any direction; the

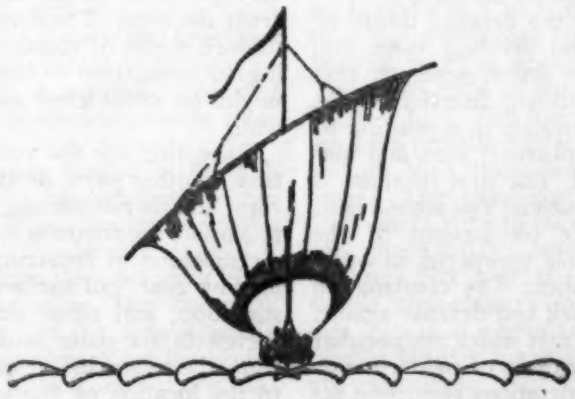
two-seater is almost as maneuverable and nearly equal in performance to the single-seater, and in close combat the latter will have very few, if any, opportunities to outmaneuver the two-seater and slip in on a blind spot. A free gun mounted in a fuselage abaft the wings cannot fire forward except above the top wing and below the bottom wing without danger of shooting holes in wings, struts, or wires. The two-seater, however, is well guarded from attack from ahead by its own fixed guns.

There can be no doubt that the two-seater fighter is superior defensively to any type of airplane in service. This defensive power can readily be applied to the protection of other types of aircraft. A close protective escort of two-seater fighters and a high escort of single-seaters seems ideal.

It has been claimed that the free gunner in a two-seater fighter will be able to move his gun only with great difficulty in the rare air at altitudes and against the blast of the slipstream. The former objection can be overcome by modifications of present oxygen apparatus. The latter objection can be overcome by properly cross strapping the gunner to the gun ring, so that as he turns his body the straps turn the gun with him, and by balancing the wind pressure on the gun by a small surface of equal area attached to the opposite side of the ring mount.

The detailed methods of combat between single- and two-seaters and the fullest advantages and disadvantages of each type will never be worked out until efficient two-seater fighters are in service. Observation planes, while perhaps similar to two-seater fighters in conventional arrangement, do not even remotely approach the required performance. Such two-seater fighters as are in service abroad do not compare favorably with the performance which can unquestionably be obtained. France, particularly, has also experimented with the large "gun carrier" type of airplane, used only to protect other types, mounting four or five free guns so arranged as to eliminate all blind gun angles when flying in formation. While this type may be worthy of further study it unquestionably has such disadvantages as large size, uselessness for any other purpose, freak arrangement of fuselage, and nacelles necessary to eliminate blind gun angles, etc.

The two-seater fighter not only seems to be the best possible protective means, but it can also add a great deal of strength when used with single-seaters in offensive and defensive patrols, preferably by "stair-step" method, two-seaters forming the lower and single-seaters the upper layer. The two-seater fighter is probably as efficient in attack by diving as is the single-seater, but owing to its slightly lower ceiling and its rate of climb, it cannot gain the superior position quite as readily. It has also been suggested that two-seater fighters should occupy the leading position in every three-plane section of fighting planes, single-seaters taking the two wing positions. Thus the section may be effectively guarded from surprise attack, and with no sacrifice in offensive power considerable defensive power is gained.



THE AUTOGIRO AS A MILITARY CRAFT

By Lieutenant Commander William Nelson (C.C.), U. S. Navy

THE Army and Navy have always inquired into the possibilities of any new machine and have endeavored to adopt it to military use. The history of aviation is replete with the part taken by the services. Each new phase of aircraft development has found the government vitally interested in the prospects presented by that development. It would appear in many cases that the interest extended could not have been founded upon the grounds of premeditated adaptation to service use. However, experience has indicated that the military organization has used its imagination to good advantage in furthering those ideas necessary for modernized strategy and tactics.

The successful conduct of warfare is dependent on machines to a much greater extent than ever heretofore. The military forces must extend themselves to determine the military value that lies in each new invention in order that they may not be surprised on the field of battle by the enemy's advantage in this respect. The work done with the early aëronautical experimenters has been the foundation for the present-day air fleet. This fleet grants an advantage of position and speed not attainable in any other manner. It is not readily conceivable how land or sea forces could succeed in any offensive or defensive action without the assistance of a full quota of aircraft.

Without analyzing the detailed duties of military airplanes and dividing them into their classes it can be stated generally that they have two outstanding functions—one, to place men and materials in a position of advantage; two, to transport men and materials at high speed. The first of these is usually a matter of altitude. The second is of particular importance on account of the great speed practicable compared to other modes of transportation. The combination permits forms of attack and defense against other things than aircraft which are peculiar to aircraft. Proper analysis of modern warfare introduces considerations regarding actions against other aircraft; and in such cases maneuverability, armament, and armor have a bearing.

Military airplanes heretofore have been of the conventional type. Helicopters, orthopters, autogiros, and even those introducing lesser digressions from the ordinary airplane have been viewed with much scientific interest but without practical application. Lack of development or particular disadvantages in comparison with the airplane have prevented their adaptation. Out of this group, however, there has emerged the autogiro. This type of craft has certain characteristics which seem to give it justification for consideration with other types of military airplanes.

The autogiro is essentially in a class by itself. It approaches the airplane in what it can do, and yet it differs materially therefrom. It is not a helicopter. In the ordinary airplane, motion forward in the air is obtained by the thrust of the propeller and lift is produced by the movement of the wing through the air. In a helicopter motion and lift originate in the horizontally placed propeller. In the autogiro motion forward in the air is obtained by the thrust of the propeller as in an airplane; the lift comes primarily from the rotor and to a small degree from the fixed wing. In vertical descent all the lift is given by the rotor and in horizontal flight about 80 per cent of the lift comes from the rotor. The rotor is free to assume its own speed of rotation in flight there being no connection to the engine. The rotor might be considered as a freely rotating wing.

Excepting for the rotor and the adaptation of other parts of the craft to suit this rotor and its functioning, an autogiro is very much like the common type of heavier-than-air machine in construction. The fuselage, landing gear, tail surfaces, power plant installation, and other details having to do therewith are quite similar to any airplane using the same kind of construction. Even as to the location of the useful load there is little that can be regarded as different. Ex-

tending from the lower part of the fuselage is an ordinary airfoil-section fixed wing of about three-quarters the area one would expect to find in the lower wing of a biplane. This wing has the tip turned up at a large angle for reasons of stability. A conventional unbalanced aileron is fitted to this fixed wing.

Extending up from the fuselage where the upper wing of a biplane would ordinarily be, is a pylon with its pivot at a point above the fuselage at a height equal approximately to the depth of the fuselage. The apex of the pylon acts as the axle and bearing of the rotor. The lift of the rotor blades is transmitted via the hub and this axle through the pylon to the fuselage. The rotor consists of a hub rotating on ball thrust bearings at the apex of the pylon and four hinged blades mounted on the hub. The rotor as a whole revolves about an axis approximately perpendicular to the longitudinal axis of the fuselage and rotates freely under the aërodynamical pressure of the relative wind independent of the power plant. The speed of rotation of the rotor is governed by the design, being practically constant for all flying conditions. Experiments have been made varying the rotor speed from 110 r.p.m to 170 r.p.m. The lesser speeds of rotation are now used.

The rotor blades approach the streamline in section, are constant in section, and have a relatively high aspect ratio. The circle scribed by the blade tip is somewhat greater in diameter than the span of a biplane of like size.

Rotation of the rotor is essential for lift. In flight this rotation is derived from movement through the air. In taking off, the autogiro can be taxied until the rotor gains speed; or, as has been done in the later machines, the rotor is geared to the engine crank shaft through a manually operated clutch. A brake can be used to stop the rotor after landing.

The rotor blades are hinged at the hub so that they can move up and down within limits to suit the forces imposed. If the blades were fixed considerably more lift would be received from the advancing blade than from the one receding. This inequality would cause rolling and the results would likely lead to disaster. Being free the blades move up and down so that the lifts on diametrically opposite blades balance each other and stability results. The advancing blade automatically rises, decreasing its effective angle of incidence, and thereby adjusts its lift to suit that of the opposite blade moving at a lower relative speed. In vertical descent all blades act approximately the same on the air so the hinging action is not essential in that maneuver. The blades are prevented by cables from going below a plane at right angles to the plane of rotation. In flight they cone up slightly, the tendency to rise due to air pressure being opposed by the centrifugal force of the blades. Equilibrium is produced automatically.

Each rotor blade is hinged also in the plane of rotation. This hinging is not entirely free. It is introduced to permit the varying loads imposed to be absorbed gradually and smoothly. Centrifugal force tends to hold the blades in the proper position when in flight, cables between the blades holding them in position when the rotor is at rest. The rotor blades are quite flexible and, were it not for the hinging actions the movements produced would require exceedingly heavy construction. The articulation of the blades also removes the gyroscopic action of the rotor, which force would otherwise be violent in results. In general, it can be stated that many tests and experiments and much study has given data for the development of an exceedingly efficient rotor.

Autogiros have been built weighing 1,000 to 3,000 pounds gross. Apparently there is no limit to the size that can be built insofar as the autogiro principles are concerned. Small high-powered autogiros as well as large patrol types appear practicable.

The outstanding feature of the autogiro is its very low landing speed. The speed ratio is given as 6 to 1. It can be readily seen then that with a high speed of 150 m.p.h. the landing speed is about 25 miles per hour. The speed ratio of the ordinary airplane is about 3 to 1. The low landing speed of an autogiro permits operation from areas much smaller than those which an airplane requires. The advantage of this is obvious. Very short runs to take off—about 100 feet for present-day autogiros—and vertical landings give a great freedom of action to simple cross-country operation. The value of this feature to a seaplane is questionable for usually landing areas in seaplane operation are expansive.

Maneuvers of aircraft can be segregated

into those necessary for safe navigation and those utilized for other purposes. In the first class are the banked turns, climbs, glides, dives, etc. In the second classification are the special turns, rolls, loops, and other acrobatic maneuvers. The acrobatic maneuvers are a necessary part of certain combat airplanes and some commercial craft. To others these operations in the air are incidental. The autogiro responds readily to the navigation maneuvers much in the same manner as an airplane, other than in its ability to hover and land practically vertically. The autogiro does not stall and acrobatic maneuvers are impracticable in this craft. Insofar as military use is then considered it becomes suitable primarily in those functions where navigational maneuvers control.

The ceiling of an autogiro is about the same as that of an analogous airplane.

The autogiro in its present stage of development has more parasite resistance than its compatriot, the airplane. Consequently its top speed is less than that of an airplane similarly loaded and powered. Theory seems to indicate that the autogiro can be brought up to the same efficiency as the airplane in this respect. At intermediate speeds the advantage of efficiency rests with the airplane.

In comparing the weight of the autogiro and that of an airplane it is only necessary to consider the difference between the weight of the rotor and its mounting and the upper wing of a biplane. It is believed that they will be practically the same when the autogiro reaches a higher degree of development. For the present then it is an opinion that the airplane has the advantage in useful load and accordingly in range.

The autogiro as a military machine logically falls into the group where navigational maneuvers are paramount. In this group it seems to have all of the features of the airplane with the added characteristics (of particular benefit to a landplane) that it can land and take off in severely restricted areas. Also its ability to hover might be utilized to advantage. One then comes to the conclusion that excluding the classes involving fighters, pursuits, scouts, and certain observation machines the autogiro can compete favorably with land-type military airplanes.

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Official Photograph U. S. Navy (Courtesy of Bureau of Aeronautics.)

SECRETARY ADAMS AND ASSISTANT SECRETARY INGALLS
Before taking off in an autogiro for conference with the President at Rapidan, Virginia.

Courtesy Aëro Service Corporation, Philadelphia

THE AUTOGIRO ON THE FIELD

Courtesy Aëro Service Corporation, Philadelphia

THE AUTOGIRO ON THE FIELD

Courtesy Autogiro Company of America

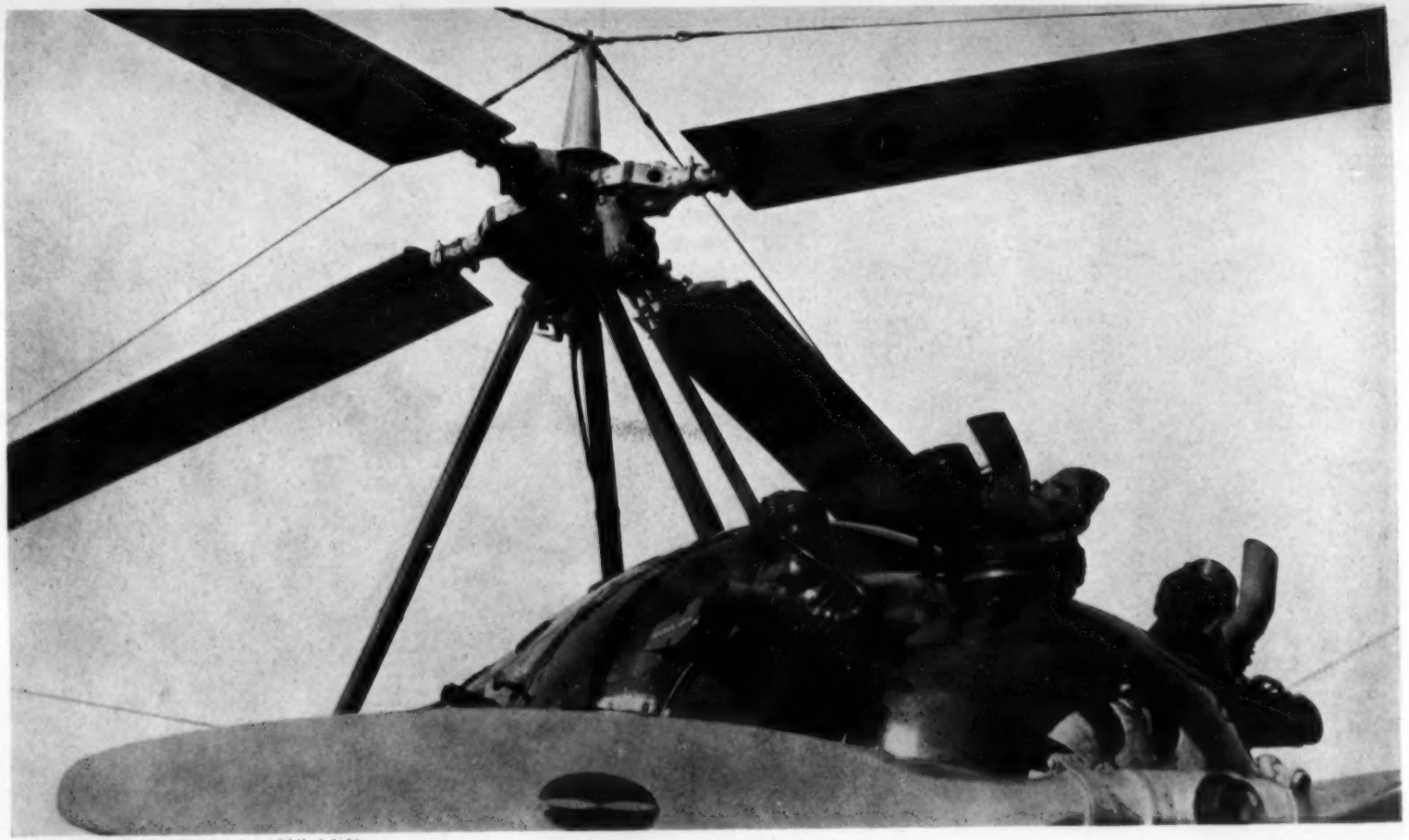
IN FLIGHT

Courtesy Aëro Service Corporation, Philadelphia

OVER NEW YORK

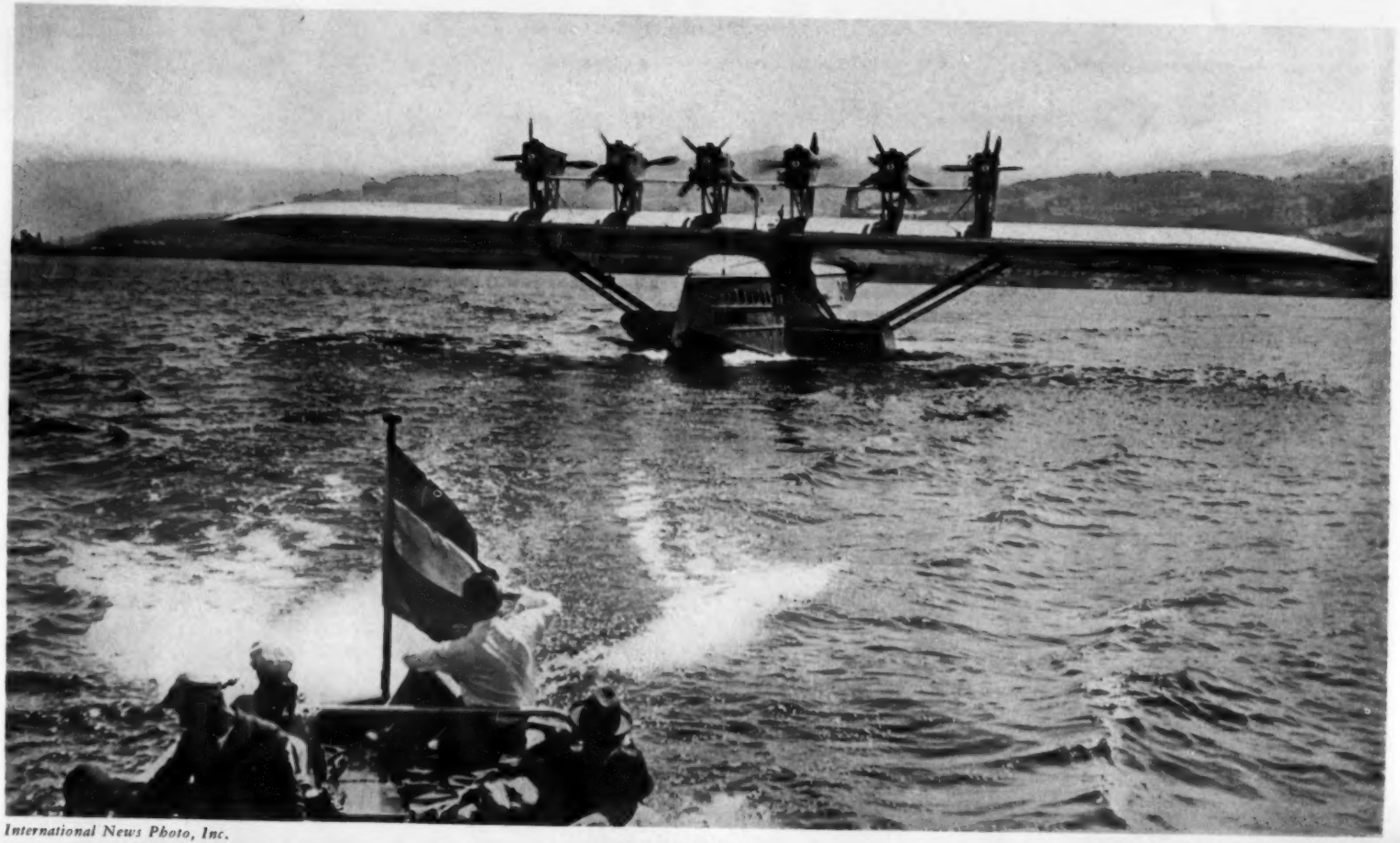
Courtesy Aëro Service Corporation, Philadelphia

OVER NEW YORK



Courtesy Aëro Service Corporation, Philadelphia

DETAILS OF THE ROTOR MOUNTING

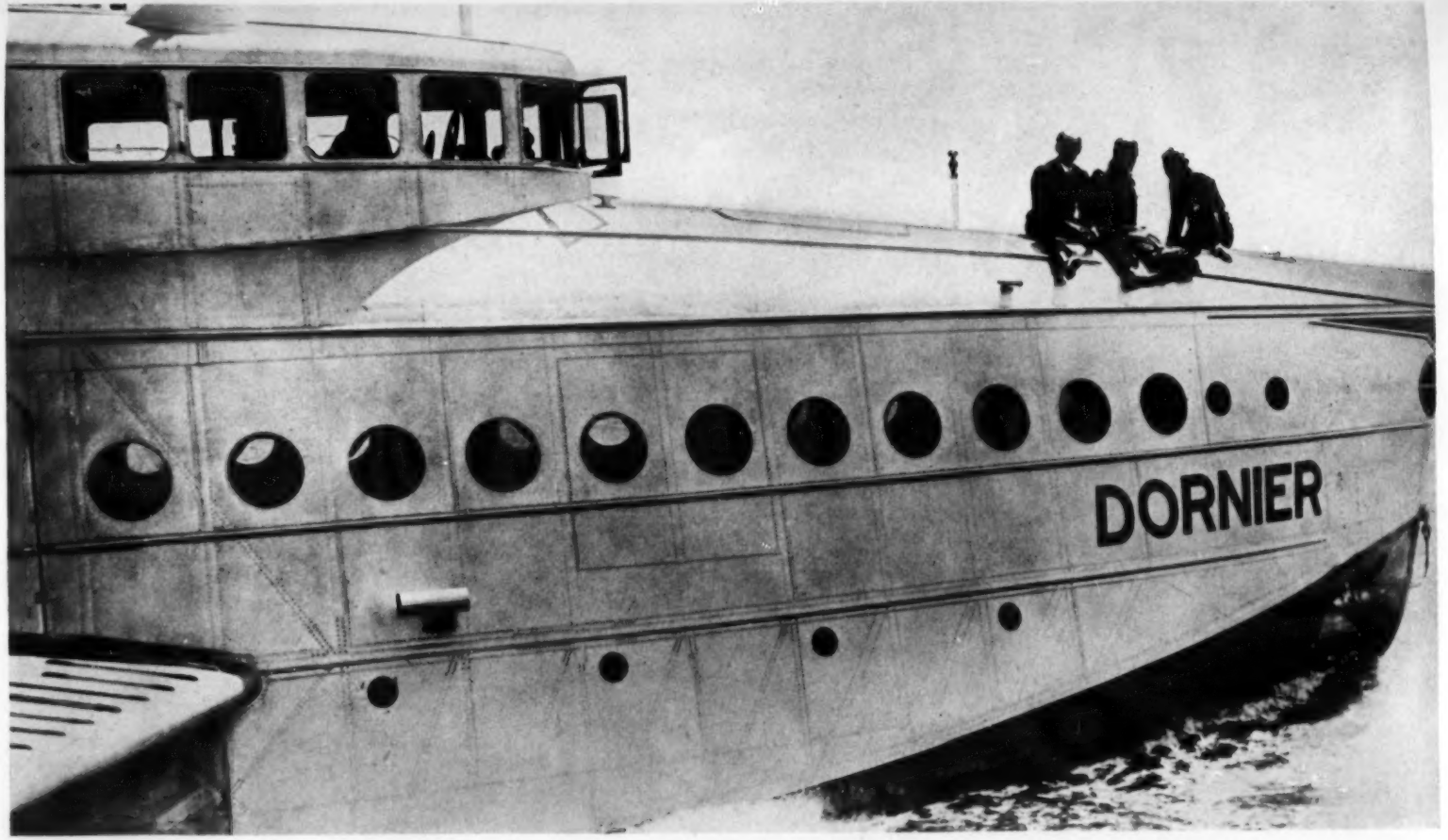


International News Photo, Inc.

THE *DO-X* ON LAKE CONSTANCE, SWITZERLAND

International News Photo, Inc.

THE *DO-X* ON LAKE CONSTANCE, SWITZERLAND



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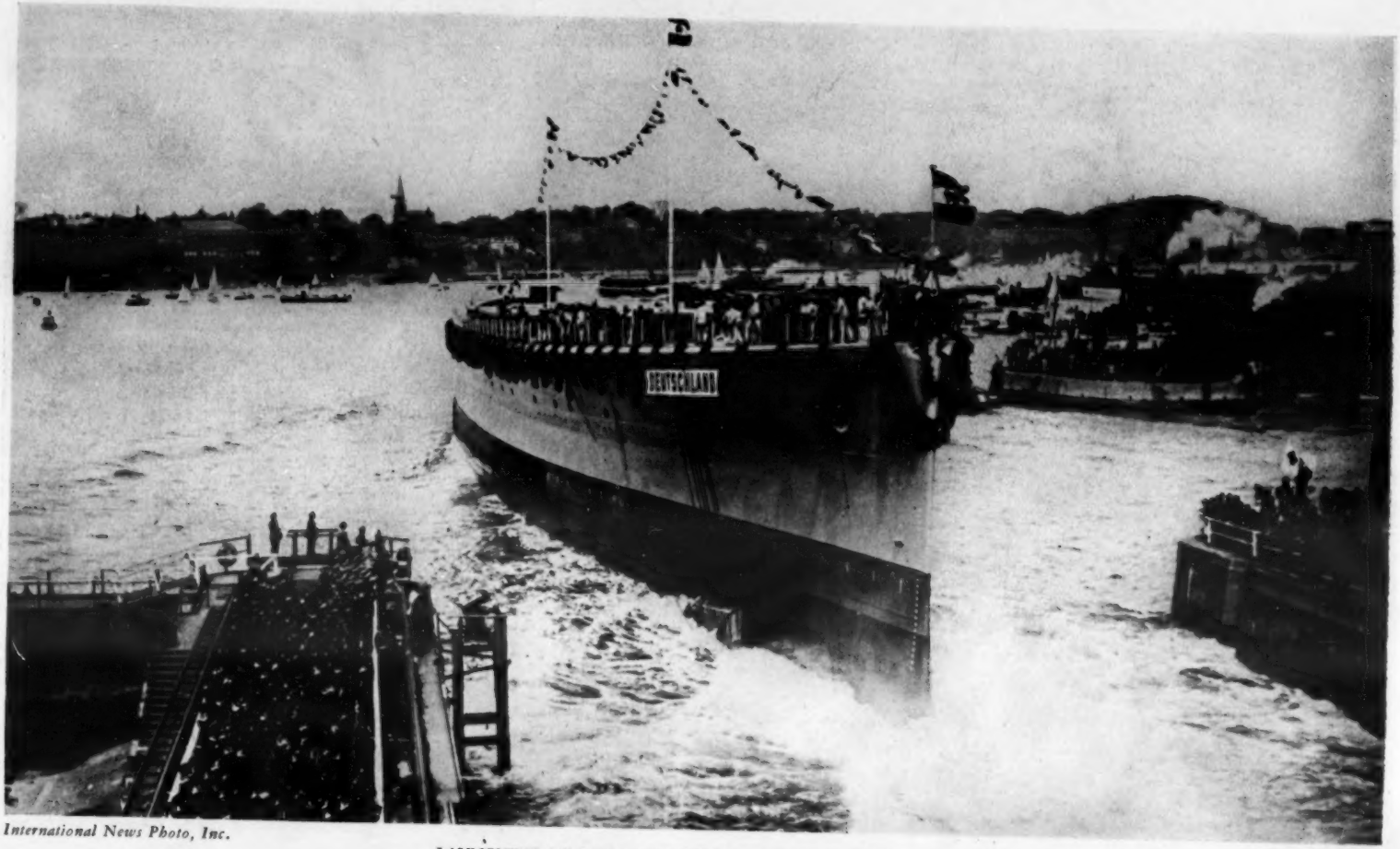
THE BOW OF THE *DO-X*



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LAUNCHING OF THE *DEUTSCHLAND (ERSATZ PREUSSEN)*
The ship took the water before being properly christened by President von Hindenburg.

DISCUSSIONS

LAUNCHING OF THE *DEUTSCHLAND (ERSATZ PREUSSEN)*
The ship took the water before being properly christened by President von Hindenburg.
International News Photo, Inc.

Exterior Ballistics—Wind Correction

(See page 630, May, 1931, PROCEEDINGS)

JAMES W. WEBB.—After reading Lieutenant Raftery's article "Exterior Ballistics —Wind Correction," it seems that although his conclusions are correct in principle, they overestimate the errors under investigation and give the reader the erroneous impression that no consideration has been given to the effects of winds aloft on a projectile in flight.

As a matter of fact, that subject has been treated extensively by ballisticians since the World War; and even prior to that time one finds range wind formulas developed to correct for a definite increase in the velocity of wind with altitude. Various methods of using winds aloft for ballistic corrections have been invented and published. Some give the exact solution, require extensive calculations and, for that reason, are suitable only for proving ground or similar work; while others, fairly simple to apply, are close approximations intended for service use. All range tables of any importance are based on firings corrected for measured variations in the upper air from adopted standards. In those range tables the wind columns are intended for use with the best estimate of wind obtainable. If upper air measurements or reliable estimates are available, they should, by all means, be given preference over surface conditions in entering such columns.

In considering the differences between surface and ballistic wind Lieutenant Raftery magnified the effects several fold by assuming that the full velocity of the air is transferred immediately to the projectile as it leaves the gun. In no case can the relative errors be of the order suggested by his computation. In 40 seconds a 1-knot cross wind will displace a major caliber projectile about 6 yards; for any other wind the displacement is proportional to velocity. Thus the 5-knot wind difference in his illustration represents only a 30-yard error.

Perhaps a more complete problem will give a clear concept of the upper wind effects. For that purpose, it will be sufficient to confine our illustration to a deflection discussion.

Suppose the range, R, to be 22,000 yards for a gun elevated, φ, to 15° and fired with an initial velocity, V, of 2,600 f.s. From ballistic tables the corresponding time of flight, T, is found to be 36.5 seconds and the maximum ordinate 5,400 feet. Using the above elements, the standard wind formula

$$D = W\left(T - \frac{3R}{V\cos\varphi}\right)$$

gives a deflection of 5.8 yards for a 1-knot cross wind.

Accurate data for winds above the ocean are not available. Therefore, to get the most probable variation between surface velocity and the velocity at the different altitudes crossed by the projectile, we will borrow from the *Monthly Weather Review*, supplement No. 26, table 5, page 20, the annual average free-air winds for a surface direction of WNW over the Florida peninsula.

Altitude (feet)	*Velocity (knots)*	*Direction (degrees)*
0	9.3	290
1,000	13.6	301
3,500	18.4	298

Having the velocity and direction of the winds aloft, it is necessary to average the effects of these winds on the projectile. The usual operation is to convert them into a single "ballistic wind" constant in intensity and direction which will have the same total effect on the projectile as the combined true winds. Theoretically, such a step re-

quires a special set of factors for the particular condition under which the gun is fired but, fortunately, a fair approximation can be had for most any condition by recourse to the time-altitude formula of a body falling in a vacuum. As customarily expressed, this is

$$y = \frac{g}{2} t^2$$

When this formula is applied to a projectile, it is evident from the symmetry of its trajectory that T the whole time of flight is equal to $2t$. Now calling the maximum ordinate Y the formula becomes

$$Y = 4T^2 \qquad (1)$$

By the same reasoning the time t spent in any vertical zone extending from the surface to an altitude y is

$$y = Y - 4\,(T - t)^2 \qquad (2)$$

Dividing (2) by (1) gives

$$\frac{y}{Y} = \frac{t}{T}\left(2 - \frac{t}{T}\right) \qquad (3)$$

This last expression, one of the original formulas used for weighting winds, assumes the weighting factor for any zone is proportional to the time the projectile spends in that zone.

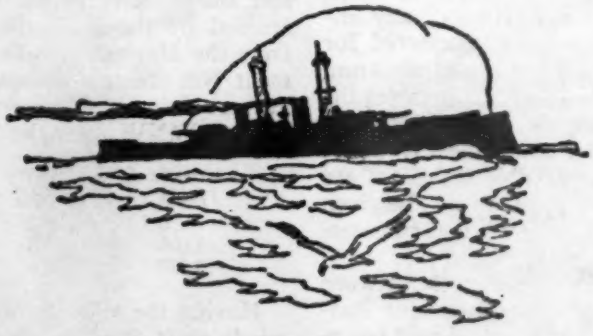
For our problem let the trajectory be divided into three vertical zones. Then using formula (3), build a table as follows:

Zone	$\frac{y}{Y}$	$\frac{t}{T}$	Weighting factors
0— 500	.1	.05	.05
500—1500	.3	.16	.11
1500—5400	1.0	1.00	.84
			1.00

Now the products of the true winds and the weighting factors just found give three ballistic velocities whose vector sum is the desired ballistic wind; in this case 17.5 knots blowing from 298°.

To get the maximum difference between surface and ballistic wind, let the ballistic wind blow directly across the line of fire. Then the cross component of the ballistic wind is 17.5 knots and of the surface wind is 9.3 cos 8° = 9.2 knots. The difference of 8.2 knots converted into a deflection error amounts to 5.8 × 8.2 = 48 yards. Further, employing a mean line of fire in place of arbitrarily shooting across the wind will reduce the error to an average right or left deflection of 34 yards.

Of course, averages are often exceeded and a special problem of the type considered furnishes no criterion for predicting the maximum errors to be expected from ignoring winds aloft.



PROFESSIONAL NOTES

JUNE 2 TO JULY 1

COMPILED BY MEMBERS OF THE EDITORIAL STAFF

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UNITED STATES

The Secretary's Radio Address

"The Navy has operated during the last two years at an increasingly high level of efficiency, yet it is daily striving to effect new and better methods and to adopt permanent economies. The forces afloat have reduced very materially their operating costs, both by reorganization and by improvements in operations. Many obsolete vessels have been stricken from the active list and sold, and many more have been placed out of commission, to be held in reserve in the event of a national emergency.

"With the ratification of the London Naval Treaty came the task of outlining a construction program which would gradually build up the various deficient classes of ships to the prescribed limits of the London Naval Treaty. During the actual treaty negotiations, work was stopped on further cruiser construction, which has delayed the normal construction program as outlined in our original 15-cruiser program. During the last two years eight of the 10,000-ton cruisers have joined the fleet, and seven are now under construction; two fleet submarines have been completed and two are under construction; one aircraft carrier is now under construction, and one dirigible will be completed this summer; the five-year aircraft building program will be completed this month.

"Plans are now being completed for eleven new destroyers, for which money was provided by the last Congress. Building of the various classes of ships has been planned so that each class will be gradually added to, thereby eliminating wholesale replacements when these ships become old and obsolete. To increase their effectiveness, as well as to increase their period of useful life, alterations have been completed or started on all but six of our battleships. The modernization of these ships is carried on in accordance with the provisions of the Washington treaty. However, our total construction has not equalled the depreciation of our ships during this period.

"Serious political disturbances during the last two years have occurred in various parts of the world. In some countries conditions were such that our naval vessels have been called on to afford protection to our citizens and interests in the disturbed areas. Missions of this type are necessary, but each visit is a difficult task, requiring the protection of American interests while at the same time striving to maintain cordial international relations. It is to the everlasting credit of the Navy and of the marines that hundreds of similar missions have been successfully and skillfully accomplished in past years.

"The fundamental naval policy of the United States requires that the Navy of the United States should be maintained in sufficient strength to support its policies and its commerce, and to guard its continental and over-seas possessions. Our naval policy is based on and is designed to support national policies and national interests, as well as to protect our homes. This policy aims to provide the number, size, type, and distribution of naval vessels and stations, the quality and number of personnel, and the character of peace and war operations necessary for national safety and protection. Any navy beyond that necessity would be unfriendly to the world and wasteful to our country.

"The training of the Navy, therefore, must have as its main objects utmost efficiency for war; competence for operations in any part of either ocean; sufficient strength for exercising such control of the sea as is necessary for the protection of American interests, and especially our overseas and coastwise commerce. Other objects are: the development of the art and material of naval warfare, coöperation with all departments of our government, and the cultivation of friendly relations with the rest of the world.

"As the outer bulwark for our armed forces, upon the Navy rests the first responsibility of safeguarding our immense sea-borne commerce and of checking and destroying, if possible, any hostile attack upon our shores, or upon our outlying possessions.

"History has many times proved the truth of the statement of President Washington in his message to Congress in 1797, when he said:

> To an active external commerce the protection of a naval force is indispensable. To secure respect for a neutral flag requires a naval force organized and ready to vindicate it from insult and aggression. This may even prevent the necessity of going to war by discouraging belligerent powers from committing such violations of the

rights of the neutral party as may, first or last, leave no other option.

During peace, our Navy is at all times a silent, yet powerful, guardian of our foreign trade routes. In case of war, it is the Navy alone which can maintain the flow of our vital sea-borne imports and exports, without which our industrial system would be seriously crippled, if not destroyed.

"Trade protection forms the basic commercial consideration for a navy. With America's foreign trade approximating ten billions of dollars annually, which represents the livelihood of 2,400,000 American families, the United States Navy, in protecting this trade, is rendering service to all sections of our country; to the wheat grower of the Middle West; to the steel centers; to the automobile manufacturer; to the cotton and fruit growers of the South and West.

"In peace time it is true that the Navy's service to our over-seas commerce is potential, yet in many instances the mere presence of our naval ships in disturbed areas has caused a cessation of hostilities, and has kept foreign seaports open which otherwise would have been closed. It is hardly necessary to demonstrate that the showing of the flag by our naval vessels, and the development of friendly relations with foreign countries by them is, perhaps, essential and surely of great benefit to our commerce.

"One of the important contributions of our Navy to the commercial activities of the country has been in connection with the shipbuilding industry. The Navy, as far back as 1882, gave impetus to the then infant steel industry by its need of high-grade steel for the construction of its first steel vessels. Up to that time high-grade steel in large quantities was available only in England. Since that time the Navy has steadily caused the employment of thousands of men and has been a great aid to the steel and shipbuilding industries.

"Naval architects, trained by the Navy, were sought after by shipbuilding companies and today former officers of the Construction Corps of the Navy are represented in almost all of our country's shipbuilding concerns.

"The Navy has taken a leading rôle in developing the art and practice of ship design and construction. Much of this success is attributable to the model basin of the navy yard in Washington. Here, ship models are towed through the water and their water resistance carefully calculated; good ship forms are developed and suitable propulsion machinery designed. This model basin is always available to commercial shipbuilders, and hundreds of models other than naval ships have been and are being tested here.

"For the hundreds of materials required for as many manufacturers throughout the country, the Navy has set up definite specifications which allow manufacturers advance notification of the materials required. The rigid requirements and inspections, and the standard specifications and classifications, have not only simplified commercial products and reduced their cost, but have brought many improvements in quality and design.

"The Navy has contributed largely in the past, and is continuing at present, to our country's knowledge and growth in the commercial fields of steel, radio, aviation, steam and electric engineering, ship construction, and in science and research.

"The return of an honorably discharged Navy man to his home carries to that community a sober, disciplined, industrious man of good character, well fitted to earn a good living. He is an asset to any community, and with thousands of other Navy-trained men forms a dependable body on which the nation may rely in case of any crisis.

"That the Navy today is offering a happy and useful service is shown by the fact that now it is obtaining better material in its recruiting than it has ever before obtained.

"The Naval Reserve is maintained to provide our regular Navy with sufficiently trained personnel to augment our sea forces in case of a national emergency. It includes the following general classes: A combatant seagoing reserve; an aviation reserve; a communication reserve; the administrative specialist and technicist classes, and a Merchant Marine Naval Reserve.

"The man-o'-war's man of today is a highly trained specialist, in addition to his military qualifications. The collective efforts of our entire naval personnel are strikingly shown by advances made in material and the art of war on the sea, and in the splendid condition in which our fleet is maintained, both in ships, weapons, and in-

struments. The fleet is ever ready for any service, both at home and abroad.

"It has often been said that our Navy has saved more lives than it has destroyed. . . . Errands of mercy have found our Navy present at the scenes of famines, earthquakes, hurricanes, tidal waves, ship disasters, and epidemics. In hundreds of calamities, in many countries, on land and on sea, our forces have done good service in the saving of lives and the relief of suffering.

"In addition to our fleet and our shore bases, the Navy maintains laboratories where new and more efficient materials are constantly being produced; an experimental engineering station; a naval observatory, where astronomical observations and research are conducted, nautical publications are prepared, and from which the correct time is determined and sent out to the country, and to ships at sea; a hydrographic office, which supervises surveys and from which nautical and aviation charts and nautical information are provided for commercial vessels of our own and other countries.

"Thus we see that the Navy is a vast organization with duties and benefits covering a very wide field of action great and small. It is an essential part of our economic life and governmental structure.

"It was established to insure the safety of our ocean commerce and of our homeland, and through many crises it has not failed. Fortunately, there has always existed public confidence in the service that carries with it mutual pride.

"So, working together, there is good reason to hope that the country and the Navy will both prosper and jointly promote the cause of justice and peace in the world."

Marine Welding Advanced

Merchant Marine Bulletin, June.—While the Navy was not the first to apply electric welding to industrial work, it was a pioneer in applying it to practical shipbuilding.

There are now building at the various navy yards three all-welded seaplane wrecking derricks, two all-welded tugs, one all-welded freight lighter, all of them being self-propelled. As a still further evidence of this development for the Navy, the forward eighty-eight feet of the four light cruisers now under construction at the navy yards are to be practically all-welded construction.

Electric Boat Gets Contract

Marine Journal, June 15.—Contract for construction of the U.S.S. *Cuttlefish,* a fleet submarine, has been awarded by the Navy Department to the Electric Boat Co., of Groton, Conn., on a bid of $3,297,000.

GREAT BRITAIN

Promotion to Sailors

New York *Times,* May 31.—The British Admiralty will put in force on June 15 a set of new regulations which will permit promotion from the "lower deck," or among the seamen and petty officers.

The principal innovations with their possibilities in the new regulations are as follows: The mate system is abolished and the title of sublieutenant will henceforth designate the first grade of officers promoted from the lower deck.

Youths in training establishments and in the merchant marine who show "desire, aptitude, energy, and promise" will be drafted to capital ships and large cruisers, so that they may have every opportunity to become acquainted with seamanship in ways which the smaller craft do not offer.

It will thus be possible, according to observations made by the first lord, for the rating of able seaman to be reached after a minimum of twelve months as ordinary seaman instead of fifteen months as at present. And so the rating of leading seaman may be reached at the age of 19½ at the earliest.

After six months' service as leading seaman, the youth with the requisite "energy and promise" becomes a candidate for a commission at the minimum age of 20½, if recommended by his commanding officer and if he has passed the required examinations. Candidates then passed by the fleet selection boards will be assembled as a class at Davenport naval barracks and go through a modified petty officers' course.

On the completion of this course candidates will appear before a final selection board and those who are selected will then receive the rank of acting sublieutenant. This may be obtained at the minimum age of 21. Those who fail will be continued on as petty officers.

The acting sublieutenants will then attend the Royal Naval College at Greenwich for one term, in a class by themselves, for in-

tensive study. They will then be eligible for the rank of lieutenant.

Similar regulations are to govern promotions in the engineering branch of the service.

Armed Merchantmen

Naval and Military Record, June 10.—As might have been expected, the question is being asked as to whether the 6,500-ton ship with 6-inch armament proposed by Admiral Sir Herbert Richmond as adequate to all naval requirements might not get a nasty surprise from armed merchantmen? Admiral Richmond had anticipated this criticism, and has dealt with it, although not so fully or conclusively as he might have done. His view that a warship is bound to be superior to a mercantile vessel in her capacity to "resist punishment" is a characteristically naval opinion, but we rather think it needs some qualification. Given approximate equality in speed and armament, the advantage should be with the specially designed warship. But the modern liner is constructed on "unsinkable" principles, and in all probability would withstand a very great deal of gunfire. The *Highflyer* was reported to have emptied her 6-inch magazines before sinking the *Kaiser Wilhelm der Grosse*, a ship built three decades ago, and even then it is by no means certain that the opening of her sea cocks by her own people was not the final cause of her foundering. In this duel the German ship was caught at great disadvantage.

It is unquestionably the fact that were Admiral Richmond's prototype accepted, she might find herself actually inferior to an armed merchantman—a very novel state of affairs for a capital ship. True, there are not very many liners capable of the 24 knots proposed as her speed, and not many mercantile ships adapted to mount anything heavier than a 6-inch gun. But the incentive would probably bring the result in the event of war. The tendency to disparage the fighting value of armed merchantmen is a mistake. Apparently it rests upon the assumption that they are virtually quite unprotected, whilst the warship is not, and that they are likely to be fought with indifferent efficiency. A 6,500-ton warship could only be very lightly protected, and the policy which justifies light protection in her case surely extends to the even lighter protection of the armed merchantman, for in neither case can it be effective against 6-inch gunfire within medium range. So long as the liner has trained gun crews there is absolutely no reason why she should not be as efficiently fought as a warship. The Americans, at any rate, recognize her as a very potential menace. Against an 8-inch gun cruiser of 30 knots and over she need not be considered at all. But to ridicule her as a serious opponent to a 24-knot 6-inch gun warship appears to us to be quite wrong, especially if she carried half a dozen aëroplanes—as she probably would—to the warship's possible one.

NAVAL NOTES

The following notes are taken from various sources:

Great Britain

The battleship *Emperor of India* is to be used as a gunnery target. She is not to be sunk but rather is to be used for firing tests so that naval constructors may draw such lessons as they can.

The Navy estimates for the coming year are £51,605,000, something less than that for the past year.

The building program includes three submarines, one leader, and eight destroyers, one 5,000-ton cruiser, and two cruisers of the *Leander* class.

During the fiscal year ending March 31, one cruiser, two destroyers, and one submarine will be completed. Work will be carried forward on some twenty-nine other vessels.

The battle cruiser *Hood* was this spring equipped with a catapult for launching aircraft.

Approximately 80 per cent of English aircraft, or all, soon will be equipped with slotted wings.

Over $2,000,000 has been spent on the air base at Singapore.

The first lord of admiralty stated in the House of Commons that 142 aircraft were available for service with the fleet.

The *Prinz Regent Luitpold* is being raised at Scapa Flow. This is the seventh capital ship to be brought up.

The fourth destroyer flotilla leaves for the Mediterranean in July. This flotilla was authorized in the 1928 estimates.

The Navy List now shows the "standard

displacement," according to the Washington treaty and "displacements by previous national rules." The "standard displacement" is greater in each case, in the case of the *Queen Elizabeth* class, by nearly 4,000 tons.

The flotilla leader *Broke* is now attached to the Royal Naval Engineering College.

It is understood that the *Effingham*, completed in 1925, and the *Frobisher*, completed in 1924, will be scrapped in the next year or two, while the *Hawkins*, of the same class, completed in 1919, will be retained.

Japan

The aircraft carrier *Ryujo*, launched at Yokohama this spring, is much smaller than the *Akagi* or the *Kaga*. She is expected to develop 25 knots, and will carry twelve 5.1-inch guns.

Japan has four 8-inch gun cruisers under construction and eight in commission; four of 10,000 tons and four of 7,100 tons. The *Chokai* was the last one to be launched and is the last of the twelve allotted to Japan under the London treaty.

The Japanese press reports indicate that ultimately the naval air service expects to have 14 shore-based squadrons, totaling 180 aircraft. These include:

Seven squadrons, torpedo bombers, 16 per squadron; three squadrons, fighters, 16 per squadron; one squadron, large flying boats, 2 per squadron; three squadrons, medium flying boats, 6 per squadron.

Italy

The government recently announced increased subsidies to shipping companies, the total amount being 230,850,000 lire.

The suggestions that reduction of war debts should be linked with reduction in armaments seem to be particularly favorably received in Italy.

Recent flotilla leaders are reported to have attained speeds well in excess of 40 knots.

The new training ship *Amerigo-Vespucci* has a 2,000-hp. Diesel engine but primarily she is a sailing training ship.

The air estimates for next year are 752,000,000 lire, somewhat in excess of those for the current year.

Admiral Sirianni, in his speech on the naval estimates, said, among other things, that he thought the English at Dartmouth took boys too young and gave them a too narrow and professional education.

Spain

Two mail and passenger ships of 14,000 tons, that are under construction, will be equipped with aëroplane landing facilities.

The *Canarias*, the first 10,000-ton Spanish cruiser, was launched at Ferrol on May 28.

France

Much discussion resulted over the government proposal to build a 23,000-ton battleship in answer to the so-called "pocket battleship" *Deutschland*. In the end the government was directed to make further study of the tonnage and characteristics for capital ships and resubmit proposals to the Chamber before giving orders for building.

No new submarines were included in France's naval construction program for next year.

The steaming records of the flotilla leader *Gerfaut* indicate that she can cross the Atlantic at nearly 20 knots. Her maximum speed is around 41 knots. The *Vautour*, a sister-ship, is soon to be completed; and sister-ships *Cassard* and *Tartu* should be launched in September.

Germany

The *Deutschland* was suddenly and unexpectedly launched while President von Hindenburg was in the middle of his speech at the launching ceremonies. The whole German fleet had assembled at Kiel for this occasion.

The Navy estimates will include provisions for the second of these "pocket battleships." The Minister of Defense, in discussing the estimates, talked upon the necessary defense for East Prussia and the strategical importance of the Baltic.

The 6,000-ton cruiser *Leipzig* should be completed shortly. A gunnery training ship is also scheduled to be completed this year.

ENGINEERING

Vacuum Tubes

Fortune, June.—The industrial revolution began with the machine. . . . It continues with the vacuum tube.

About 200 uses have already been found for the electronic, or vacuum, tube in industry. For instance, it measures. It can measure an electrical current of only sixty-

three electrons a second—an infinitesimal whiff of energy equal to about 1/100,000,000,000,000 of an ampere. It can and has measured the bend on a table top caused by the weight of a twenty-five-cent piece. More practically, it measures the thickness of manufactured paper rolling from the machine. In a wire mill, it assures uniform diameter of wire. In astronomy, with the assistance of a thermocouple, it measures the heat of a star. It saves coal by registering on a dial how much smoke is going up the chimney. It produces artificial fevers to combat disease by generating high-frequency currents. It counts. By rigging a photo-electric cell so that each package from a machine casts a shadow on the cell, no possible speed of production can flurry it into error. It can even sort. It sorts out bad peas and beans, and it grades cigars according to their shades (a finicky job once intrusted to lifelong experts). Withal, the upkeep of this versatile workman is next to nothing at all; perhaps $25 a year, perhaps $100.

Spray Rustproofing

Engineering, June 5.—A new development of some considerable importance is that known as Spray-Sherardizing or Spray-Rustproofing. This process consists in spraying zinc dust, similar to that employed in the older processes, on to structural-steel surfaces after erection is complete; it is stated to be suitable for coating bridges, buildings, roofs, ships, tanks, and other similar structures. The first step in the process is to clean the surface to be treated by means of steel brushes, in order to loosen and remove all adhering dirt, old paint, rust, etc. A coating of bright-green bitumen-base paint is then applied by means of an ordinary paint sprayer, and when this has dried to the tacky stage, zinc dust is sprayed on, employing a pressure of a few pounds per square inch only. The bright-green tint of the paint forms a contrast with the grey color of the zinc dust, and the operator can be certain that he has covered the entire surface. The zinc adheres firmly to the layer of paint, and the whole becomes finger-dry in about two hours. After complete hardening, a tenacious and durable protective coating is obtained. Here again, owing to the fact that the zinc is electropositive to the underlying metal, rust does not spread beneath the coating, as may occur in the case of some paints after exposure. The Spray-Sherardizing process is stated to be no more expensive than painting, and the resultant coating is claimed to be two or three times as durable as ordinary paint. As the pressure used is low, the face and hands of the operator need not be specially protected; moreover, unskilled labor may be employed to carry out the spraying operation.

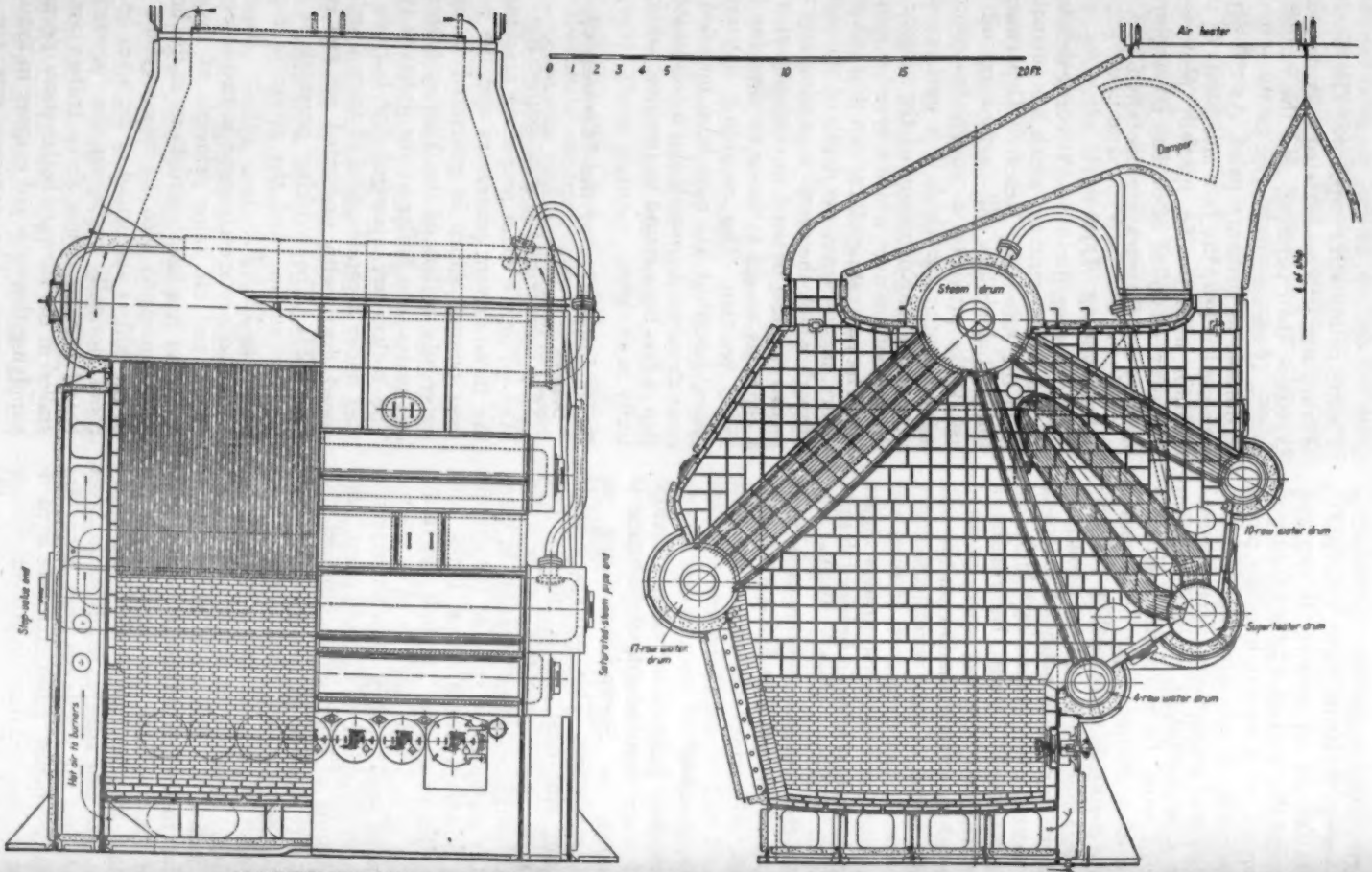
Echo-Sounding Apparatus

Engineering, June 5.—A recent development in echo sounding, which has emanated from the Admiralty Research Department, and will doubtless still further extend its use, is the provision of continuous recording apparatus, by which it is now possible to obtain a graphic record of the contour of the sea bottom over which a vessel is steaming. The navigating officer can thus see at a glance, at any time, the depth of the water through which the vessel is passing and the record can also be used, in conjunction with a chart, as an aid to fixing or checking the ship's position. The recording apparatus above described has now been installed in some twenty-four vessels and we understand that it has been found to function satisfactorily in all cases.

Boiler Installation of the "Empress of Britain"

Ship Builder and Marine Engine Builder, May.—For the main propelling machinery, the turbo-driven generators and the main feed pumps, steam is generated in eight water-tube boilers of the Yarrow type and one water-tube boiler of the Johnson type. The boilers are arranged for burning oil fuel under a combination of forced and induced draft with preheated air and open stokeholds. The working pressure is 425 lbs. per sq. in., and the steam is superheated to 725° F.

The boilers are arranged in two compartments, and the same principle of division of power has been carried out in the boiler arrangement as with the main engines. Six of the boilers are placed in the after boiler-room, normally supplying the forward inboard engines, while three boilers are installed in the forward boiler-room, normally supplying the outboard engines in the after engine-room. The arrangements are such that all or any of the boilers can supply the larger ahead and astern turbines in the



ARRANGEMENT OF YARROW HIGH-PRESSURE BOILER, WITH YARROW SUPERHEATER AND AIR HEATER FOR THE *EMPRESS OF BRITAIN*.

forward engine-room. Under cruising conditions, only the after section of water-tube boilers will be used. As the after engine-room will be out of use also, the personnel will be much reduced.

There are three funnels, and these are so arranged that the forward one deals with all the gases from the forward boiler-room, and the middle funnel with the gases from the after boiler-room and the auxiliary engine-room; while the after funnel, which is a dummy and is situated above the engine-room hatches, is used for ventilating purposes.

The Yarrow boilers are each of the double-flow, side-fired type, having one steam drum, three water drums, and one superheater drum, as will be seen from the cut which shows the details of the boiler. The flow of the gases is through both sides of the boiler, after which it passes through a large tubular air heater and thence to the funnel. The superheaters and air heaters are also of the Yarrow type.

The boiler and superheater drums are hollow rolled forgings, with ends formed integrally, and without either longitudinal or circumferential seams or joints. This represents the latest practice for high-pressure boiler work and is a specialty of the makers.

The steam-generating heating surface of each Yarrow boiler is 12,444 sq. ft., and the superheating and air-heating surfaces are 6,577 and 14,629 sq. ft., respectively. The combustion-chamber volume is 2,685 cu. ft., and there are seven oil burners of the Wallsend-Howden type per boiler.

The generating tubes have been supplied by the British Mannesmann Tube Co. and the superheater tubes, which are of mild steel, have been manufactured by the Talbot-Stead Tube Co., who have also been responsible for the boiler and superheater tubes for the Canadian Pacific liners, *Duchess of Atholl* and *Empress of Japan*. The total length of superheater tubing is 184,000 ft., and its weight is 125 tons.

For separating and spacing the superheater tubes, Messrs. Monel-Weir, Ltd., have supplied 3.75 tons of "Nimol."

The Johnson boiler, consists of two large-diameter drums placed vertically one above the other and connected together by curved tubes, longitudinally and across the ends, so that the combustion space is almost entirely enclosed by water tubes. In addition, there is a water-tube wall along the center of the boiler, which divides the combustion space into two compartments.

This arrangement of tubes provides for a considerably larger amount of tube surface being exposed to radiant heat than in other types of marine water-tube boilers. The side generator tubes are arranged in straight-line rows, and the superheater tubes are interspaced between the generator tubes. The upper ends of the superheater tubes are expanded into the top of the steam drum, inside of which is a box, which receives the superheated steam, and from this receiving box the steam passes through internal pipes to the stop valve secured in the drum shell. There are three burners of the Wallsend-Howden type spraying into each compartment of the combustion chamber, and the hot gases after leaving the boiler pass through a large tubular air heater.

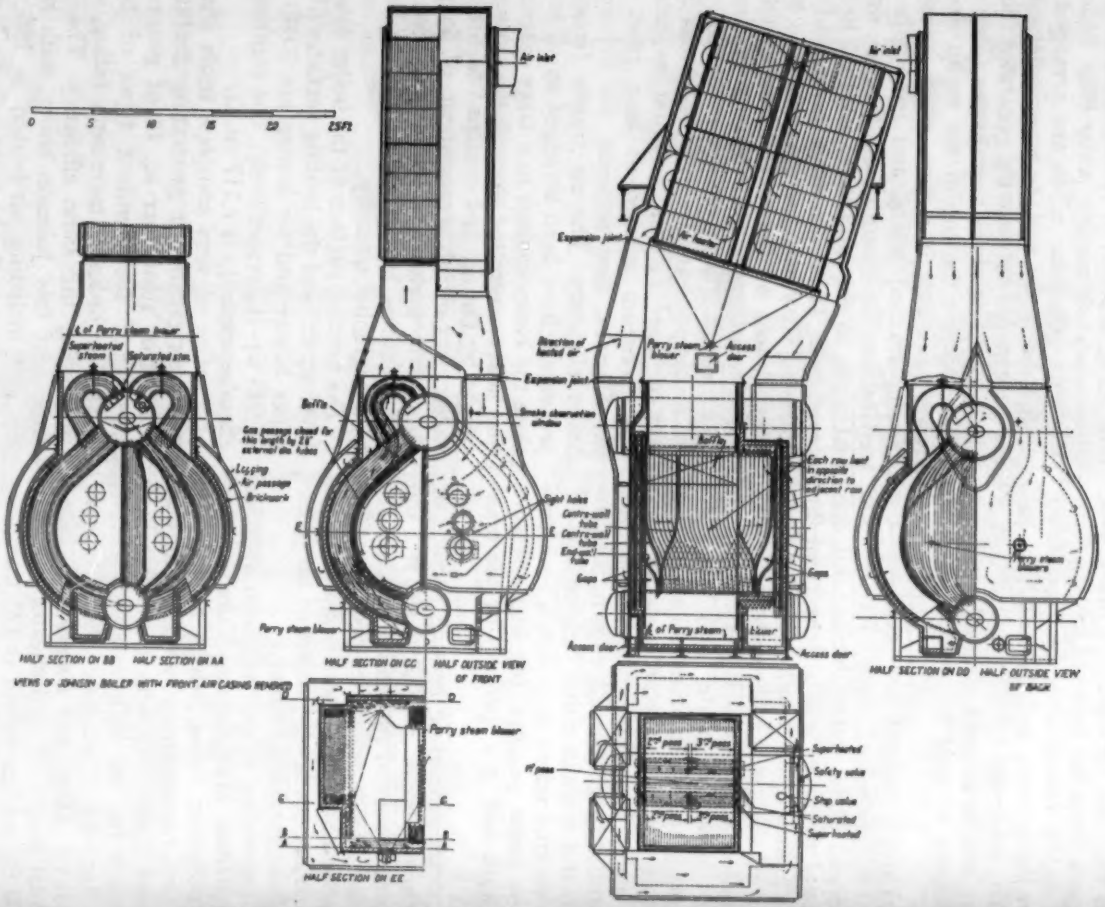
The air preheaters are of the tubular type and of large surface, in order to extract the maximum amount of heat from the waste gases, thus securing the maximum boiler efficiency. The air trunks from the preheaters have been arranged so as to enclose the boiler casings to a large extent, so that heat transmitted through the casings is caught by the air and returned to the furnaces. A careful arrangement of lagging outside the preheaters, hot-air passages, and boiler casings has reduced radiation losses to a negligible quantity.

The heating surface of the boiler tubes is 6,841 sq. ft., and the heating surfaces of the super heater and air heater are 3,840 and 23,943 sq. ft., respectively. The combustion chamber capacity is 1,117 cu. ft.

A series of very complete trials showed that it is capable of generating double the amount of steam per sq. ft. of generating surface of the standard types of boiler worked at ordinary mercantile rating, while registering the same efficiency. The total weight of this Johnson boiler, with steam up and including air-heater, is 166 tons. The corresponding weight of the Yarrow boiler is 244 tons for a smaller output.

Six "Supreme" vortex return-flow boiler separators have been supplied for drying the steam from the boilers in the after boiler-room; while Tompkins patent tangential dryers are fitted in the forward boiler-room for this purpose. In these dry-

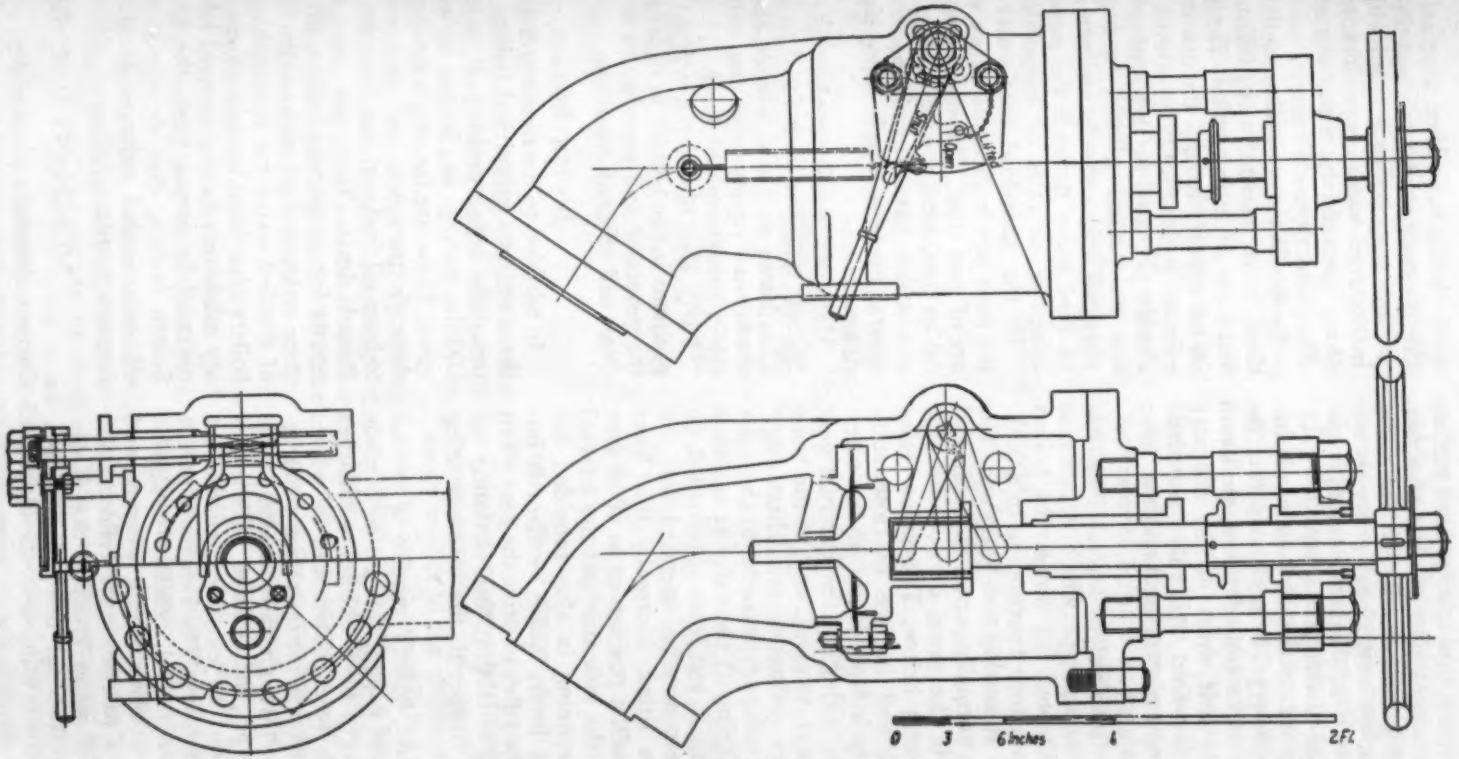
ARRANGEMENT OF YARROW HIGH-PRESSURE BOILER, WITH YARROW SUPERHEATER AND AIR HEATER FOR THE *EMPRESS OF BRITAIN*.



VIEWS OF JOHNSON BOILER WITH FRONT AIR CASING REMOVED

GENERAL ARRANGEMENT OF THE JOHNSON BOILER AND AIR HEATER

GENERAL ARRANGEMENT OF THE JOHNSON BOILER AND AIR HEATER



COCKBURN SELF-CLOSING BOILER STOP VALVE.

ers steam entering through the fixed turbine vanes is discharged into a whirl chamber, in which the kinetic energy of the water separated out by centrifugal action is utilized to return it to the boiler through special tangential discharge cones.

The safety valves are of Cockburn's improved high-lift type. It is claimed that the areas of the valve and of the waste-steam pipe are only half those of the ordinary type of safety valve. The valve seats and spindles are of stainless steel and the valve lids of nickel alloy.

The boiler stop valves are of their improved self-closing type which is being so extensively adopted for water-tube boilers since its satisfactory functioning in a well-known Clyde steamship two years ago. The valves, which normally permit an outflow of steam, will, in the event of a boiler tube bursting, prevent inflow. The inflow valve is nonreturn, and is free to close automatically quite independently of the external gear. The spring on the external gear assists the valve to close, and at the same time prevents pulsation or "chattering." The external indicator is useful to show the amount of opening of the valve at any time while steaming. A test lever is provided, by which the gear may be operated and the internal valve lifted. Normally this lever is locked in such a position as to allow free movement of the indicator and the internal valve. Over-running is also provided for at the testing lever, which renders it impossible for the valve to drive the gear when either opening or closing, thus obviating the possibility of danger to the man operating it.

High-pressure boilers require a special design of water gauge; this gauge is made entirely of forged steel. The boiler branches are fitted with screw-down shut-off valves having chain wheels for operating from below. The blow-through valve is also of the screw-down type, and is fitted with a universal joint and an extended spindle for operating from below. The Dewrance patent transparent water-level indicator is also of special design to suit the high pressure, and is fitted with a patent louvre reflector for illuminating the water level, so that it can easily be seen from the firing floor below.

Nine air-pressure gauges of the dial type with balanced diaphragms, compounded for pressure and draft, with a range of —1 in. to + 1 in., have been supplied to register the pressure in the combustion chamber.

Each main boiler is fitted with two automatic feed-water regulators, one of the Weir contraflo type and the other of the Mumford type.

In the Weir contraflo regulator the ball float, lever, needle valve, fulcrum pin, and links are of monel metal. The check valve is of simple design, and its movement is effected hydraulically by means of the discharge pressure of the feed pump. There are no packed glands, springs, or diaphragms, and a steady and continuous flow of feed water through the pumps is maintained at all rates of evaporation.

In the Mumford feed-water regulators the float box bodies and check valve bodies are of cast steel. The regulators are identical in construction with a large number of sets which have already been supplied to several modern vessels using high-pressure steam.

Mumford low-water alarm gear of a very efficient type has been fitted to each boiler. This blows an alarm whistle and shuts off the oil-fuel supply when the water falls below a predetermined level.

Parry soot blowers, are fitted at various positions in the boilers, in order to maintain the generator and superheater surfaces in a clean and efficient condition.

SCOTCH BOILERS

In addition to the nine water-tube boilers, there are two cylindrical boilers of the return-tube type, working at a pressure of 200 lbs. per sq. in., in the forward boiler-room. These are for ship's heating and other domestic purposes, and they are arranged to burn oil fuel with the Howden system of forced draft. They are also scavenging agents for water-tube boilers, thus ensuring pure make-up feed and adequate quantities of distilled water for replenishing the main boilers after cleaning operations. All auxiliary machinery having internal lubrication is operated by steam from the low-pressure Scotch boilers, thus definitely segregating oil-contaminated exhaust from the high-pressure system.

MERCHANT MARINE

Current American Shipbuilding

Nautical Gazette, June 13.—On May 1, 1931, American shipyards were building, or

under contract to build for private shipowners, 183 vessels aggregating 396,886 gross tons, compared with 173 vessels aggregating 408,851 gross tons on April 1. However, out of this total tonnage under way, seagoing tonnage showed a slight decline. On May 1 there were 26 seagoing vessels of 1,000 gross tons and over listed, aggregating 309,647 gross tons, while on April 1 there were 27 vessels aggregating 319,006.

The following is a list of steel, self-propelled vessels of 1,000 gross tons or over under construction as of May 1, 1931:

SEAGOING VESSELS

Shipyard	No. and type of vessel	Approx. gross tons per vessel	Total gross tons	Owner
Bethlehem S.B. Co.	3 pass. and cargo	17,500	52,500	Oceanic Steamship Co.
Bethlehem S.B. Co.	3 pass. and cargo	7,200	21,600	United Mail SS. Co.
Bethlehem S.B. Co.	1 tanker	1,534	1,534	Standard Transp. Co.
Federal S.B. Co.	4 pass. and cargo	11,000	44,000	Grace Line
Newport News S.B. Co.	2 pass. and cargo	21,900	43,800	Dollar SS. Line
Newport News S.B. Co.	3 pass. and cargo	7,500	22,500	United Mail SS. Co.
Newport News S.B. Co.	2 pass. and cargo	5,700	11,400	Eastern SS. Lines
New York S.B. Co.	1 pass. and cargo	8,041	8,041	Export SS. Corp.
New York S.B. Co.	2 pass. and cargo	30,000	60,000	United States Lines
Sun Shipbuilding Co.	4 tankers	9,000	36,000	Motor Tankship Corp.
Sun Shipbuilding Co.	1 pass. and cargo	8,272	8,272	Am. So. African Line
Total	26		309,647	

Confusing Lights

Nautical Magazine, May.—"Has the time not arrived when riding lights for vessels at anchor in roadsteads, harbors, etc., be made more distinguishable?

"Every master and officer will agree that the numerous shore lights intermingling with the riding lights of vessels at anchor in practically every port and roadstead make the task of distinguishing vessels at anchor an arduous one.

"The present system could easily be improved for the betterment of safer navigation when approaching an anchorage at night.

"Loaded oil tankers, when at anchor, show a red light amidships as a distinguishing signal, to denote the nature of their cargoes; therefore could not every vessel do similarly with some additional colored light to augment the present regulation lights for a vessel at anchor?"

The shipmaster whose suggestions are reported above is quite right; it is not only such ports as New York that these difficulties arise, but at practically every bay or river port, where piers and esplanades display multitudes of lights extending in some instances for two miles or more; and on carnival nights it would puzzle the "keenest-eyed" to pick out the anchor light of a vessel. On nights when water carnivals are held, and hundreds of small craft participate with blazing torches, Japanese lanterns, and colored lights of every description, safe navigation is practically impossible without grave risk of danger to life through collision.

The numerous advertising displays may appear attractive and spectacular to persons on shore, but to the shipmaster they are an abomination. A vessel is not even safe when at anchor, still less so when navigating.

How can the difficulty be overcome without adding a colored light which might be confused for a moving vessel? A blue light is a poor illuminant, while some starboard sidelights appear blue in certain atmospheres. Possibly it might be difficult to introduce an additional light without upsetting the whole gamut of the regulations.

It would be comparatively easy, in the case of a large vessel, to display an electrically controlled occulting light of a definitely distinguishing character; but it might be difficult to extend this improvement to small craft, who in the majority of cases show lights of less than one-candle power.

There is no lack of suggestions available; one might continue making them almost indefinitely. The situation is such *that an improvement in the method of indicating a vessel at anchor after dusk is not only desirable but urgently necessary.* We are living in an advanced age, not in the days when ships entered or left ports at the top of high water and when port traffic was but a tithe of its present activity. Regulations regarding vessels at anchor have stood still, and masters, officers, crews, owners, insurance companies should recognize that the time is long overdue when the improvement of anchor lights and fog signals in the interests to safety of life and property must be overhauled.

The Business of the Sea

Nautical Gazette, March 30.—The business of the sea is a very great factor in maintaining the peace of the world. The exchange of goods and the journeys of passengers bring us closer together and suggest sympathetic consideration for the legitimate hopes and aspirations of the people of other countries. The business of the sea, however, is not run for this purpose. We give a necessary service and ask from our own nationals a fair amount of patronage at paying rates. American manufacturers and exporters and importers have it in their power to insure the success of our merchant marine by using our services to the extent that foreigners use the ships of their nationals.

AVIATION

The Navy's Autogiro

Bureau of Aëronautics, Navy Department, June 1.—The autogiro (designated as *XOP-1),* which was contracted for on January 22, 1931, was delivered to the U. S. Navy at the U. S. Naval Air Station, Anacostia, on June 1, 1931. The required demonstrations will be made by the contractor and the machine turned over to the flight test section for service tests, following the delivery.

The Assistant Secretary of the Navy for Aëronautics, David S. Ingalls, Rear Admiral W. A. Moffett, Chief of the Bureau of Aëronautics, Captain J. H. Towers, Assistant Chief of the bureau, and officials of the Pitcairn Autogiro Corporation were present when the delivery was made.

The autogiro is fundamentally a heavier-than-air craft, deriving its lift from the rotary movement of its supporting surfaces through the air. It differs primarily from the airplane in that its supporting surfaces or blades are free to move at a speed independent of the machine as a whole, thereby introducing flying characteristics hitherto impossible of accomplishment.

The stability and control of the autogiro are similar to the ordinary airplane with certain exceptions. For longitudinal stability and control it is provided with a normal fixed stabilizer and elevator, and for directional stability and control, the ordinary fin and a rudder.

Two small fixed wings with upturned wing tips provide lateral stability and serve the dual purpose of carrying the ailerons and providing a convenient mounting for the wide undercarriage. The control surfaces of the autogiro are designed to be effective at both fast and slow flying speeds.

The rotor system is the essential characteristic of the autogiro and gives it its name. It furnishes approximately 80 per cent of the lift at high forward speed, and 100 per cent in vertical descent. It consists of a set of four hinged blades mounted on a hub which rotates on ball thrust bearings set on a pylon structure above the fuselage. These blades rotate freely under the aërodynamic pressure of the wind produced by the movement of the machine. The rotor is wholly independent of power from the engine, whose sole function in flight js to propel the autogiro. There can, therefore, be no cessation of rotation while the machine is in the air.

When the autogiro is in flight the rotating blades are subjected to two major and opposed loads brought about by natural forces. Under the action of lift the blades have a tendency to rise since they are free to move about the hinge at the roots. This tendency to rise is overcome by the centrifugal force of rotation acting at right angles to the lift force. The equilibrium of the two forces results in the rotor system coning slightly in flight.

One method employed for bringing the rotor up to sufficient rotational speed for take-off is the mechanical self-starter. It derives its power directly from the engine crank shaft through a manually operated clutch and brings the rotor up to speed in

less than a half minute. In flight it is completely disengaged and has no connection whatever with the rotation of the blades, thus eliminating all torque reactions found in helicopter experimentation. A simple braking arrangement similar to the familiar wheel brake stops the movement of the rotor after the autogiro has landed.

The purchase of the autogiro is in keeping with the policy of the Navy Department and the Bureau of Aëronautics, to test new developments and working inventions in the field of aëronautics to determine their potential value to the service.

Upon the occasion of the presentation of the Collier trophy to Mr. Harold Pitcairn and his associates by President Hoover, on April 22, for their work in "developing and making practical application of the autogiro," Admiral Moffett made the following statement:

> The Navy is very interested in the possibilities of the autogiro. We have ordered one so that experiments may be carried out toward determining its adaptability to naval needs. The ability of the autogiro to land within a limited space and its ability to hover over one point should make it extremely useful for reconnaissance work over bad country where adequate landing fields do not exist. There can be no doubt but what the development of the autogiro is the outstanding achievement in aviation during the past year.

Service Parachutes

Bureau of Aëronautics, Navy Department, June 15.—The development of the parachute now standard in the Navy is a comparatively recent one, dating from the closing year of the World War. Numerous successful exhibition jumps had been made from balloons and from a few airplanes prior to this time, but the primary attempts to adapt such equipment to airplanes presented difficulties due to the different problems involved. The fact that the aviator must be able to leave the plane in a position other than in straight flight, together with the possibility of the release line becoming entangled in the structure of the plane with resulting failure to operate or premature opening, made the employment of an attached type wherein the releasing device is attached to the aircraft, uncertain and hazardous. This necessitated the development of a manual releasing device, with no attachments to the plane of any kind.

Parachutes consist essentially of a sail of cloth supporting, by means of a system of suspension lines, the weight to be lowered. This design dates back for many years and has proved itself to be the most practical one yet devised. Various radical departures from this original principle have been proposed, but none have functioned in a satisfactory manner. This leads to the conviction that the problem today is one of refinement rather than invention. All the major improvements in design and manufacture have taken place within this country, largely under coöperative supervision of the Bureau Aëronautics and the Army Air Corps. The majority of the larger foreign governments have adopted this standard design without notable change.

Having accepted a conventional design for parachutes, development is now being concentrated upon the following improvements: General refinements of the sail, both in method of construction and material; a container for the sail, providing more compact stowage and suitable protection to the parachute; means of attaching the pack to the wearer while in the plane to provide added comfort without restricting movement; and an adjustable, safer, and more comfortable harness for the descent.

Silk is recognized as the most suitable material for the manufacture of the parachute sail, due to its low weight, high strength, and compactness when packed. However, the bureau is endeavoring to develop other fabrics which will possess these desirable features and which may be available for use in case this country is separated from the silk supply for any reason.

Investigation and development work is also being conducted on quick-connector and quick-detachable types of harnesses. The quick-connector is designed for passengers of transports, machine gunners, and other personnel who would be handicapped by the continuous wearing of parachutes. This requires the wearing of the harness only, with the chute stored in a convenient place near by. In case of emergency, one motion only is required to snap the chute into position on the wearer, after which it functions in the same manner as a regular parachute. The quick-detachable feature is designed to release the wearer instantaneously from his harness and parachute in case such is necessary upon landing. This is advantageous in landings in water when the wearer desires to be relieved from extra weight, or land-

ings in a high wind to prevent being dragged along the ground before the chute is collapsed.

It is required by government regulations that parachutes be worn by all personnel in all types of naval aircraft, except in specific cases where exemptions are made by commanding officers when the use of parachutes would tend to increase the hazards of the personnel. That such a regulation is justified is borne out by the fact that the lives of over fifty Navy pilots have been saved by the use of parachutes. The Navy takes great pride, and deservedly so, in the fact that not a single failure has ever occurred, provided the parachute had opportunity to function. This can largely be attributed to the care exercised in procurement and maintenance of this equipment.

Parachutes for the Navy are constructed under government supervision, of materials specified by the Navy and according to Navy design. They are inspected at the time of procurement, and every chute is drop-tested, followed by another inspection. The purpose of this drop-test is to ascertain certainty of action, opening time, rate of descent, strength, and behavior in flight. After acceptance and issue to the service, parachutes are unpacked and examined at least once each month. At this time the fabric, cordage, webbing, and release mechanism are carefully inspected. After parachutes have reached the age of three years, and each year thereafter, they are returned to the Naval Aircraft Factory for inspection, overhaul, and drop-test. At the end of a five-year period they are withdrawn from service and replaced by new parachutes.

Mooring Mast for the "Akron"

Aëro Digest, June.—Construction of the giant mobile mooring mast which will be used to handle the Navy airship *Akron* in ground operations has been practically completed by the Goodyear-Zeppelin Corporation at the airship factory and dock, Akron, Ohio. The mast is 76 feet in height, weighs 130 tons, and is moved over the ground by a 240-hp. gasoline engine.

Designed to be sufficiently stable to provide an all-night mooring for a Zeppelin, the chief utility of the mast will be in pulling the ship in and out of the dock. The mast is backed into the dock, the airship attached and pulled out mechanically, eliminating the necessity of a large ground crew. Aiding in this operation are docking rails, built out from the dock, and to which side handling lines of the ship are attached. Once outside the dock, the side handling lines are released from the rails, allowing the ship to swing into the wind. Upon landing, the same process is repeated, the mobile mast providing power to pull the ship back in the dock.

The mast is an open pyramid, or tripod, with the corners of its triangular base equally spaced on a circle 100 feet in diameter. At each of the three corners of the base is a caterpillar tractor, the two rear tractors serving to drive the mast forward, the forward tractor being used for steering.

Upon the triangular base is mounted a small machinery house, which contains a 240-hp. gasoline engine and an electric generator. Underslung between the two rear tractors is a 125-hp. electric motor. From these units, power is transmitted to the two rear tractors. Power generated by the gasoline engine is transformed into electricity in order that a smooth, steady application of energy to the driving tractors may be had.

Mooring devices, consisting of a cone on the nose of the airship, and a cup on the mast into which the cone fits and is locked, are standardized on all airships and masts, thus enabling any airship to moor to any mast. Consequently, the head of the new mast, which is 76 feet above the ground, is essentially the same as provided in high masts. A new feature is that three plungers used in locking the mooring cone of the ship in the cup on the mast may be released simultaneously by the rotation of a cam; in previous masts each plunger is released separately. A winch is provided to haul in the main mooring cable as the mooring cone of the ship is drawn into the cup on the mast.

Because many airship flights are made at night or in the early morning, provisions have been made for the installation of floodlights on the Goodyear-Zeppelin mast.

The mast has been constructed so that it will be possible to increase its height with little difficulty in order to accommodate ships of increased size at later dates.

The mast, a "motorized hitching post" for airships, is of the type developed by the U. S. Navy at the Naval Air Station, Lakehurst, N.J., and operated there successfully in ground operations of the *Los Angeles.*

New British Catapult

Army, Navy, and Air Force Gazette, May 28.—A demonstration was given at Farnborough on May 21 of the new land type of catapult designed for launching into flight aircraft of the largest size. A Vickers' Virginia twin-engined bomber, weighing between eight and nine tons, was catapulted into the air, with Squadron Leader W. S. Caster and Flight Lieutenant J. A. T. Ryde as first and second pilots respectively. It is intended to demonstrate the device for the first time in public at the Royal Air Force display on June 27.

The new catapult was designed and built at the Royal Aircraft Establishment, Farnborough. It is intended primarily for the launching of multi-engined aircraft, and differs in many essential features from the type of catapult used for launching aircraft from ships, which have been in use in the Royal Navy for about five years. Heavily loaded aircraft often have difficulty in leaving the ground, as the engines fitted are not sufficiently powerful to apply the extra acceleration required to enable them to take off with a reasonably flat run, even though they may be quite adequate when once the aircraft is in the air. The 4,000 hp. which operates this catapult is derived from compressed air, although it is stated that steam or cordite may be used. The apparatus operates by traction instead of propulsion as on board ship. The compressed air motor revolves a drum, round which is wound a cable leading to a pulley in the ground some distance in front of the apparatus, and thence back to an attachment under the fuselage of the machine. As the drum revolves, the aircraft is pulled forward, running on the wheels of its own undercarriage, with its tail on a special wheeled trolley to bring it into flying position. Towards the end of the run, the retarding mechanism of the catapult releases both the cable hooks and the trolley. Within about three seconds, the aëroplane is in flight, after a run of 40 yards, at the rate of 60 miles an hour. On one occasion, the aircraft was catapulted at the speed of 60 miles an hour and left the ground in about 34 yards.

The value of the device in allowing large or small aircraft to be launched from small aërodromes, and even from places where there is no proper landing ground, is obvious. At the same time, it is well not to be over-optimistic about the uses of this so-called mobile catapult in doing away with the need for aërodromes in the rear of an advancing army. The large concrete base of the apparatus has to be considered. Once in position, the device is admirable, but it is not such as could be easily and simply transported.

Aërial Weather Observations

Bee-Hive, June.—Somewhere, high above clouds that sometimes obscure the vision of surface observers with the Navy's three fleets, weather is in the making. In the "upper air" storms gather to hinder operations not only of the aircraft squadrons, but also of the capital ships.

On a few occasions aviators and observers have pierced the sky dome to great altitudes; a very few times fliers have looked down on the earth from planes that had climbed more than eight miles straight up. But theirs was only a passing acquaintance with the upper airs. They contributed little toward making possible frequent and reliable weather reports.

Now the Navy sends planes up to an altitude of two miles every day, measuring with instruments those factors from which aërographers chart the weather. Trained observers note cloud formations and movements in order to interpret more intelligently the charts that later are compiled.

Wasp-powered planes carry the flying weather men aloft. From the U.S.S. *Wright, Jason,* and *Saratoga,* one with each fleet, the weather men take off each morning for their two-mile hop. From several naval air stations, scattered between Sand Point, Washington, and Pensacola, others fly. They comprise the Navy's own weather bureau, and on the basis of their investigations, charted each morning, the air squadrons fly and Navy movements generally are planned.

A single rather simple but delicate instrument riding on the lower wing of each plane records in red ink on a turning cylinder the data which later are interpreted in terms of storm and fair weather. The observer plays a relatively unimportant part in the weather flights. The weather map can be drawn from the information recorded on the aërograph without the aid of an observer's personal assistance.

As the planes rise each morning the aëro-

graph begins to record a story of conditions about which even the most expert aërographers know little. The aërograph in a few minutes takes down its own mechanical observations of temperature, humidity, and pressure. As a clock mechanism turns the cylinder three stationary pens press against the paper covering to note each change in conditions.

Just as pressures build up toward the center of the earth, air is more dense at the surface. While the air surrounding the globe weighs less than one-millionth part of the earth's weight, that millionth still represents a considerable load. It may be interesting to note that the average weight of air pressure down on each square foot of the earth's surface is 2,000 pounds, while the whole atmosphere weighs nearly 60 billion tons.

Although 27,000 cubic feet of air are required to make one ton, the aërograph measures any change in weight quite accurately. This is done through a standard "pressure can" the top of which moves up as the plane ascends and down as the pressure forces it inward. The top of the can is connected by a shaft to one of the recording pens and its delicate movements are faithfully recorded.

Humidity gives one of the most important clues to the weather. To measure the moisture in the air, a bundle of human hairs attached to each instrument lengthens and shortens with variations in the atmosphere. These, likewise, are attached to a pen that traces a humidity line on the chart.

Temperature measurements are easily taken through a curved metal thermometer that straightens and curves in varying degrees of heat and cold.

The Navy probably has gone further with the Wasp-powered planes used to carry several of the observers up each day to determine what's going on in the upper air than has any other organization. While eight-mile-high flights with proper instruments probably would reveal much valuable information on the gathering of storms, for the moment no weather planes fly higher than 10,000 feet because with his present ground equipment the weather man can use data recorded to only that height.

Storms generally take place in the lower tenth part of the atmosphere, although many of them originate higher up. Sounding ballons have gone up to an altitude of about twenty-two miles and records made from their flights have given valuable information. Whether sending a plane up beyond the eight-mile level would bring down anything of value remains to be learned, but the difficulties inherent in such flights probably would more than offset the value of the data. The atmospheric pressure is reduced 50 per cent at an altitude of 3.2 miles, and at 8 miles it is only about one-eighth that at sea level. Somewhere farther up toward the world's roof the pressure would be entirely diminished and ordinary flying, of course, impossible.

Navy pilots and observers in Wasp-powered planes are doing a great deal toward developing knowledge of the air. The weather bureau plans soon to take upper air soundings with airplanes, and it is expected their contribution will be of importance. Today the hazards of high altitude flights do not even approximate those of a few years ago when equipment had not been developed. Fifty-six years ago in a balloon ascent two Frenchmen died and the third became unconscious. Many explorations have continued since that tragedy, however.

One of the odd facts about the upper air contradicts an earlier theory. It long had been thought that the higher one goes the lower the temperature drops. In 1902, however, Teisserarc de Bort, a Frenchman, discovered from balloon thermometers that the temperature dropped up to an altitude of about 30,000 feet. After that altitude, however, the temperature remained the same as high as the instruments were carried, possibly another twelve to fourteen miles.

This demonstrates that the air consists of at least two layers, and all flying today is done in the lower layer, known as the troposphere. All the heavy winds blow in the troposphere, while in the upper layer, known as the stratosphere, the air remains calm and without variation of temperature. Storms and their components, lightning, rain, etc., take place in the lower six miles.

Another discovery, which is of importance today to the Navy observers, resulted from experiments seeking to determine the maximum height of the troposphere. These experiments revealed that the height varies as one moves away from the equator. Along that belt the troposphere reaches an altitude of ten miles, while in the neighborhood of Boston it diminishes to six miles and drops

to four miles over the poles. This has its effect on storms. Oddly, the coldest area ever found in the air exists directly above the equator. A balloon sounding made from the island of Java in 1913 with the temperature 76°F. at sea level revealed the temperature to be 130° below zero at 55,000 feet. Above that area, however, as the instruments and balloon continued to rise, the temperature remained constant. Thirty thousand feet above the 55,000 foot level the temperature was 60° warmer.

While these appear to be great altitudes, the air extends on up to a maximum approaching 150 miles above sea level. These upper regions are not of importance to the Navy's weather men, however. Radio people would like to know more about them, for somewhere between the 40- and 70-mile levels the atmosphere reflects radio waves. Just why this quality should exist no one knows.

Clouds, forerunners of storms, gather in the lower six miles. Stringy cirrus clouds, lumbering cumulus, and the greater thunder clouds forewarn of storms. Some of the thunder clouds may extend two miles from bottom to top. Not infrequently the Navy's observers fly up through heavy layers of clouds and observe weather in the making while flying along the roof. Clouds tell their stories of gathering disturbances, and their conditions, written on aërographs, enable the forecasters to predict with accuracy coming downpours. Navy flyers are learning to place more reliance on the weather man's reports. Following a given flight, say from the *Saratoga*, a forecast of local conditions for the day is provided to pilots with the battle fleet. Later these recordings are correlated with those from other instruments set up at widely scattered points to form a more complete weather picture for the three fleets.

What the aërograph actually records in its three wavering lines is the energy existing at various levels. To the layman the lines on the chart mean nothing. In fact, aërographers must, by an involved mathematical process, enter them on a second chart known as a tephigram before their meaning becomes apparent.

These weather flights are of more importance on a clear day than during weather that appears to the layman to be stormy. Not infrequently the charts reveal the coming of a storm in two or three hours which in the absence of such a warning might catch whole squadrons of planes flying far from the carrier or a land station.

MISCELLANEOUS

Lloyd's, London

Fortune, June.—If you go in through the door of Lloyd's, you will meet an attendant in scarlet and gold livery. At your request, if you have a friend among the underwriters, he will summon him by writing out a message with an electric pencil. Make no mistake by calling this scarlet and gold personage a doorman. He is a "waiter," and derives his title from the days when the institution was a coffeehouse in the second story of a building with a frontage of 14.5 ft. on Lombard Street.

With your friend the underwriter, you will be permitted to enter the room—the subscriber's room, the coffeeroom, that is, where there is no longer any coffee. It is today a spacious hall. Except for aisles and a space in the center, it is entirely filled with tables, on both sides of which are pew-like benches—an old coffeehouse arrangement.

Through the aisles are wandering a throng of insurance brokers, each one holding little slips of paper on which various proposed insurances are written. The brokers go from one table to another, offering risks to underwriters who sit there with their clerks. If an underwriter accepts an offer, he merely takes the broker's slips, writes down the sum which he insures, and places his name or initials after it. The transaction is completed; the broker goes upon his way.

In the center of this busy room stands a rostrum under a marble canopy, the successor of a pulpit (mentioned by both Addison and Steele in their essays) that once stood in Lloyd's Coffee House. Two and a half centuries ago, the pulpit was used by auctioneers who sold merchandise from overseas, and also ships "by inch of candle" —that is, a short length of candle was lit and the vessel knocked down to the highest bidder at the instant that the flame burned out. In that old pulpit also, waiters used to mount to read to the house's patrons the latest news dispatches from overseas.

Today, there is one important addition to pulpit. Over it hangs a bell. In 1799,

H. M. S. *Lutine* sank with a cargo of gold off the coast of Holland. Lloyd's underwriters of that day paid their dues, and for sixty years, until part of the *Lutine's* treasure was salvaged, the matter was forgotten. From the rudder of the *Lutine* an elaborate and uncomfortable chair was carved for the chairman of Lloyd's; and the ship's bell was hung over the rostrum—not to be silent, however.

When the clear tone of the *Lutine* bell rings through the room, silence falls among brokers and underwriters. From the rostrum a caller announces the news of a ship overdue or unhappily foundered.

Such is the unusual setting of Lloyd's. More unusual, and centuries old, is the peculiar way in which the organization functions. The corporation of Lloyd's writes no insurance. It exercises a supervisory function at most, somewhat after the fashion of the New York Stock Exchange. There are no insurance companies in Lloyd's; there are only individual underwriters—men who singly, for a fee, will guarantee you against loss and, if necessary, will have to pay you with their every farthing and the shirts upon their backs. If the particular underwriters who sign a policy are unable to make good on it, however, the insured has no legal claim against the other underwriters of Lloyd's, although he is protected by guarantee policies by which underwriters insure one another and furthermore by the fact that the underwriters would certainly make good the policies of a bankrupt member rather than impair the prestige of Lloyd's.

At the beginning of this year, there were 1,423 underwriting members of Lloyd's. They are grouped in about 140 syndicates of from six to a hundred underwriters each.

The relationship of the members of a syndicate is best explained by following the foundation of such a group. Someone, often an insurance broker (who is familiar with Lloyd's because he obtains policies there), decides that he would like to be "agent" for a syndicate (i.e., manage it). He approaches a number of wealthy friends and persuades them to join. If those joining are not already underwriting members, they must become so. Each is introduced to the chairman of Lloyd's, who talks to him and decides whether he thinks him suitable in character. If the chairman approves, the prospect's financial status is investigated. Generally a prospective member must expect to show assets of at least £100,000. This being shown, six members of Lloyd's indorse the nomination, and the newcomer, then making a minimum deposit of £10,000, paying an entrance fee of £500 and an annual subscription of £30, is elected an underwriting member.

These underwriting members are underwriters or insurers, but business is done, not by them, but in their names. Hence the designation, "names." The agent who organized them (their business manager) hires a man who sits in the Room and does the actual underwriting, for which they are the sureties. This active underwriter is the one who really executes insurance in the names of the syndicate.

In practice, if anyone wishes to obtain an insurance policy from Lloyd's, he must go to a broker. The broker takes a slip describing the risk to the room, where he goes from one to another of these active underwriters, each of whom subscribes the sum which he undertakes on behalf of his syndicate. When the total desired insurance is subscribed, Lloyd's policy signing office makes out and issues a policy which is signed not by Lloyd's Corporation, but with the "names" of the several syndicates—of the men who must make good in case of loss.

The active underwriter chosen to write insurance for the "names" of a syndicate must obviously be familiar with the business; either he has held such a post before, or has been a clerk or deputy to an underwriter. Usually he is a "name," too; but if he is a penniless man who has risen from a clerkship, often a syndicate will agree to stake him if he shows a good profit for three or four years.

It is essential from the standpoint of a "name" that he be a man of means. From the beginning, interest on his original deposit and premium balance is credited to him, but for three years he cannot draw a penny. On the contrary, he has to pay income tax on his profits, although he cannot touch them. If, instead of there being a profit, losses are greater than premiums, the "name's" deposit is impaired, in which case he may retire from Lloyd's (not getting the remainder of his money, however, for several years, until all claims are settled) or

more likely his syndicate will sack its underwriter and hire another.

At the end of three years, each "name" can draw from his funds on deposit with Lloyd's up to the amount of a year's profit, on the basis of the average for the period. After the first three years, not only the accountings but the payments are made annually. Ordinarily, a "name" leaves a part of his profits, for the amount of premiums that can be written for him increases in proportion to the size of his deposit. So it is that a syndicate increases its underwriting capacity. The amount of a "name's" profit, of course, varies. The first year that he draws, a "name" expects to get £500 (5 per cent on his £10,000 investment), and hopes for £600 or £700. Thereafter, as he draws year by year, he hopes to get £1,000 (which is considered good), and perhaps eventually £2,000 a year (very good), besides proportionate increases as his investment grows. This profit is net, the agent seeing to it that all expenses are paid first. The amount, of course, always depends on the active underwriter's ability to pick good risks.

This underwriter's profits grow with those of his syndicate. His salary is very small, and he depends on his percentage of the profits (up to 10 per cent) for his chief income. A small profit for an active underwriter is £2,000 a year. There are a good many who make £10,000, and probably two or three who make £30,000 or £40,000. These incomes are very large, even larger than they appear by multiplying them by five to convert them into dollars, for salaries are lower than in the United States.

The corporation of Lloyd's stands apart from all this trafficking in insurance—apart and overlooking it. Its function is to see that none but proper subjects of the King become members of the society (aliens are never admitted); to guard the funds which underwriting members are required to deposit with it; to audit the accounts of members very strictly so as to insure that members will be capable of meeting their obligations. There is a committee of twelve members which keeps a very watchful eye on the business that is done. A new chairman of the committee is elected annually.

Lloyd's name and growth.—In the time of the Restoration, Edward Lloyd, a worthy Londoner, set up a coffeehouse. He did a good business selling coffee; his coffeeroom was always full of merchants exchanging the news which was vital to their business and attending the sales for which the coffeehouse became noted. When he died in 1713, his name was carried on by his business. The prosperous institution he had created, a coffeehouse, not an insurance business, was inherited by one of his waiters, who married his daughter, Handy Lloyd.

In Edward Lloyd's time, marine insurance in London was carried on, in no particular place, by individual merchants. Seven years later, at the height of the speculative boom over the South Sea bubble, two marine-insurance stock companies were chartered, and given a monopoly of the business except for the individual underwriters. To combat the threatened competition, the underwriters drew together. Lloyd's Coffee House became their common place of business. As it happened, the two companies never wrote much marine insurance, so for 100 years the monopolistic provision of their charters protected Lloyd's underwriters from competition. Lloyd's did probably 75 per cent of Great Britain's marine insurance.

In 1769, the underwriters, dissatisfied with the management of the coffeehouse, persuaded one of its waiters to set up a new Lloyd's (after which the old Lloyd's soon went out of existence). The real importance of the change was that the underwriters had to band together for the first time, in order to provide proper quarters for the new house. Thereafter they became subscribers, had a room of their own, paid an admission fee of £15 and two to four guineas a year dues.

This informal organization developed slowly—only as step after step was forced upon it. Other qualifications for membership than a £15 admission fee had to be imposed, for in a few decades the original seventy-nine subscribers swelled in numbers to 1,400 or 1,500, as many as today. When public criticism was leveled at Lloyd's, the committee which had served to provide quarters had eventually to lay down regulations for the conduct of business. In 1866, for the first time, new members of Lloyd's were required to make a deposit to secure the insurance they wrote. In 1870, Lloyd's was finally chartered by Parliament.

Meanwhile, the insurance scene had changed. Nathan Rothschild had established

himself in England, and in company with a number of English financiers wished to enter the marine-insurance business. He applied to Parliament for repeal of the monopoly of the two existing marine-insurance companies. Lloyd's had beaten off one such proposal in 1811, but Rothschild was too much for the underwriters. In 1824, the monopoly was repealed and a crop of new marine-insurance companies sprang up.

From early days, some nonmarine insurance had been written at Lloyd's. In the last fifty years this business has grown tremendously (although not given a recognized standing until 1911). Today, syndicates at Lloyd's are either marine or nonmarine. How much business the underwriters of Lloyd's write in a year is not a matter of record. It is probably in the neighborhood of £30,000,000; and because of the rapid developments of the last ten years, more than half of this amount is nonmarine.

Prosperity and depression.—There is not a calamity that has affected the commercial world in centuries which has not had a momentous effect on the underwriters of Lloyd's. One of the first on record was the disaster to the Smyra fleet in 1693, when Edward Lloyd was still master of his coffeehouse. England and Holland were at war with France, and in May of that year a fleet of 400 merchant vessels set out for the Levant. In the Bay of Lagos, they and their escort of twenty British men-of-war were surprised by a large French fleet. A quarter of the English and Dutch merchantmen were sunk or captured. The loss was £1,000,000, the larger part of which fell on the Dutch; but the remainder was sufficient to ruin many of the underwriters of London. Among those who were bankrupted was one named Daniel Foe (who put a "de" before his surname when he appeared as a journalist).

The next great blow fell in 1780. In that year, a combined Spanish and French fleet fell upon the outbound East and West India convoy, capturing fifty-five of sixty-three ships. The losses were around £1,500,000. Another crop of failures was harvested among the underwriters, and this time they included John Walter, the founder of the London *Times*.

British shipping suffered heavily during the American Revolution and the Napoleonic wars; and British ships were not Lloyd's only losses, for the underwriters insured not only neutral, but enemy ships as well. (It was argued that a profit made by dealing with the enemy was all to the good.) Consequently, a British victory was often as costly to the underwriters as an enemy victory. When war broke out with Holland in 1794, the underwriters suffered heavily because all Dutch ships and cargoes in British ports were thereupon confiscated.

Yet, in spite of heavy war losses during the last century and a half, Lloyd's has never been shaken as it was in 1693 and 1780. In times of war, losses are high but premiums are higher. On the occasion of the sinking of the *Titanic*, the underwriters of all countries swallowed hard and paid out several million pounds, of which Lloyd's share was undoubtedly heavy. Storms on the Atlantic, even when no ship sinks, bring heavy losses to Lloyd's, for battered vessels, battered and brine-damaged cargoes, sometimes add up to tremendous bills of damages. However, the worst condition for the underwriters is that which they have now—when thousands of ships are tied up idle, carrying no insurable cargo, paying trifling premiums on hulls safe from most dangers of the sea.

Lloyd's business.—It is partly due to this maritime depression that Lloyd's nonmarine business has of late years outgrown its much older marine brother. There is much gossip about the gambling policies which Lloyd's underwriters write. Any policy on a risk by which the insured stands to lose no money is, of course, merely a gamble. Lloyd's as an institution frowns severely on such business. Under English law, it is in most cases not illegal but invalid; that is to say, payment from an underwriter cannot be enforced at law.

Actually, gambling policies of any kind are few and far between. Lloyd's, however, prides itself on the fact that its underwriters will write virtually any risk by which a man may lose money. Some strange policies of this sort are written. Insurance against having twins is fairly common, and the demand for the policy comes mostly from the United States. Fire and liability insurance are written in quantity; insurance on good weather for outdoor amusements, on burglary, on blooded stock (race horses, etc.), on the feet of dancers, and the hands of pianists.

In days gone by, far stranger risks were written—pure gambling risks such as insurance on marriages, on female chastity, on the death of public men (who, reading in the newspapers what their odds were of survival, despaired of life and died), on the surrender of bisieged cities, on the fall of politicians from power, on the price of stocks. A policy is in existence, written in 1813, at a premium of three guineas per 100 pounds, that Napoleon Bonaparte should not "cease to exist or be taken prisoner" within thirty-one days. The Spanish fleets from America were insured, and the slave ships coming from Africa. In a policy of 1794, the slaves were valued at £45 each; the premium was at a rate of $21 per $100 from Liverpool to Cuba via Africa. In connection with insurance on slaves as goods in transit, a legal decision has survived which holds that "if a slave destroys himself from despair," the fatality should be classed as a "natural death." As antislavery agitation grew in England, it was first ruled that no insurance could be collected on slaves jettisoned at sea, and finally insurance on slaves was abolished.

Life insurance alone is not written at Lloyd's—because an underwriter might die before the insured, and there is no perpetual body, such as a corporation, to pay the claim. For the same reason, Lloyd's policies are limited to one year.

In relation to the United States Lloyd's holds a peculiar position. Once it wrote much United States nonmarine insurance, mainly because United States insurance companies used not to write as many types of insurance as they now do. Today, Lloyd's is kept out of the United States chiefly by the insurance laws of the forty-eight states, laws devised to protect Americans by providing that underwriters doing business here must keep certain reserves within the state, and permit themselves to be sued here. Lloyd's ignores these regulations, and continues to do business in Leadenhall Street only.

United States insurance men do not weep over this situation. Lloyd's underwriters can cut premiums because of low overhead—with half a dozen clerks and no office except the room, an underwriter at Lloyd's may take in for his syndicate as much in premiums as a good-sized United States insurance company with offices covering perhaps two floors of a large office building.

Lloyd's, however, gets considerable United States business from our insurance companies who reinsure a part of their policies—to distribute risks, to make a profit on insurance already written, and to make way for writing more—just as banks rediscount their bills. In this way, Lloyd's not only performs a service to United States insurance, but gets a considerable amount of business. According to the 1930 report of the U. S. Shipping Board, of $60,442,000 of gross marine premiums written in the United States, $8,696,000 was transferred as reinsurance to "non-admitted" foreign underwriters—of which sum, no doubt, much went to Lloyd's.

It is impossible to get any reliable figures on the part of Lloyd's in the international insurance market. It is generally admitted that (outside of life insurance, in which the United States holds the palm) the major portion of the world's insurance is still undertaken by Lloyd's and the British insurance companies. If it amuses you to make a more or less wild guess from the wholly inadequate estimates available, you might arrive at some such figures as the following in regard to, say, the division of the marine portion only of the insurance business.

	Annual marine premiums
Lloyd's	$60,000,000
British companies	65,000,000
U. S. companies	40,000,000

The best way to visualize Lloyd's as an underwriting institution is to pretend that it is what it is not—an insurance company. On that basis (and remembering that the figures are merely estimates), one finds a company that has:

Annual gross business (premiums)	$150,000,000
Dividends to stockholders (members)	5,000,000
Salaries and commissions of executives (underwriters)	3,000,000

Aside from a $10,000,000 building, there is very little capital invested, although there are individual reserves (only a fraction of which are nominally pledged against any given policy) totaling $60,000,000, and probably at least ten times that sum in the private fortune of the members, which represent the real resources of the institution. Such is Lloyd's today.

NOTES ON INTERNATIONAL AFFAIRS

From June 4 to July 3

Prepared by Professor Allan Westcott, U. S. Naval Academy

INTERNATIONAL DEBT MORATORIUM

American Proposals.—On June 20 President Hoover issued a proposal for relief of world economic depression by a general suspension of payment on all debts owed by Germany to the former Allied powers, and all debts owed by the latter among themselves, for a period of one year. The reparations payments from which Germany would be thus released amount to about $400,000,000, and the debts due to the United States on which payment would be suspended reach a total of $262,000,000. The immediate influences leading to President Hoover's proposal were not clearly revealed, though from reports of Ambassador Sackett in Germany and Secretary Mellon in London, as well as press reports of German conditions and the rapid flow of gold out of the country, it was evident enough that Germany was facing an economic and perhaps a political upheaval, which if it occurred would be frought with unlimited possibilities of injury to the world economic structure. Before his announcement the President consulted many leaders of both parties, and received practical assurance of congressional support. The proposal was very generally welcomed abroad and brought the immediate result of a marked rise in security and commodity values and a general feeling of encouragement for the future.

England, Italy, and Germany at once signified approval, and by the end of June the American State Department was able to announce that, with the exception of France, the plan had been accepted by all nations concerned. England took definite action by announcing postponement of debts due from India and British commonwealths, and some other countries took corresponding action with regard to their creditors.

French Obstacles.—The French government realized that action must be taken in line with the debt moratorium proposal, but also felt keenly that it must not be rushed. Had Germany herself proposed suspension, there would have been a committee of investigation in which France would have participated, and no doubt also a conference—the politician's panacea. The French counter-proposals, made after full parliamentary approval, suggested that there should be technically no suspension of the unconditional reparations payments from Germany, amounting to $131,000,000, but that this should be placed to the account of Germany's creditors in the Bank of International Settlements and then reloaned directly to German industrial and financial concerns, with the exception of $25,000,000 which should be saved out for central European countries. Evidently by this method the money not paid this year would be collectible the year following, in addition to the regular payments of that year, thus placing a double burden on Germany. France also expressed concern over the deposit of over $100,000,000, which under the Young Plan she would have to make for the benefit of Germany's lesser creditors, in case Germany failed to make the conditional payments.

Much of this was viewed by the United States as contrary to the spirit of the American proposals, especially the scheme for repayment only a year hence. The American idea was that all payments not made this year should be merged in the general debts and

become payable in installments over periods of at least twenty-five years. Extended conversations were held in Paris, with Secretary Mellon and Ambassador Edge as American representatives. An American memorandum of July 1, while offering opportunities for compromise, declared that certain of the French counter-proposals constituted a departure from the Young Plan, which France professed to wish maintained, and furthermore that if the American proposal was not adopted and Germany thereupon demanded a suspension of payments, as she would be forced to do, France would find herself worse off by $100,000,000, for she would have to make her payments to England and the United States. In view of the pressure brought to bear on France, it appeared certain at the time of writing that a satisfactory compromise would be reached —otherwise France would stand in unpleasant isolation from the nations with whom she has coöperated heretofore.

THE CHEQUERS CONFERENCE.—Save as a renewal of friendly intercourse between the two countries, the visit of the German chancellor and foreign minister to London, June 5-9, had no immediately noteworthy results. Germany's economic plight was presented, and while Great Britain declined to take the initiative in an appeal to America, the discussions doubtless had something to do with the American moratorium proposals ten days later.

A return visit of Premier MacDonald and Foreign Minister Henderson to Germany was scheduled for July 17. The German ministers also made arrangements to visit Paris and Rome sometime during the same month.

GREAT BRITAIN

BRITISH FOREIGN POLICY.—The leading article in the July issue of the quarterly *Foreign Affairs* is "The Permanent Bases of British Foreign Policy," by Sir Austen Chamberlain, British Foreign Minister, 1924-29. Sir Austen begins with the three fundamental geographical conditions which control British foreign politics: (1) That England is an island; (2) that she is separated by only a narrow streak of water from the continent; (3) that she is "the center of a wide-flung empire whose arterial roads are in the oceans and through the narrow seas." He points out that aëronautical developments have given new force to "the secular principle . . . that the independence of the Low Countries is a British interest . . . their safety inseparable from ours." This is one motive for British involvement in the Locarno treaties. Another motive for British participation in these treaties, as he sees it, is to compose the quarrel of France and Germany and bring the latter country back "into her rightful place in the counsels of Europe"—in other words, though Sir Austen does not use the outworn phraseology, to maintain a balance of power on the continent.

Turning to the influence of British commerce and communications on policy, his discussion is chiefly interesting for its justification of British concern in Suez and Egypt on precisely the same grounds which justify our special concern in the Caribbean:

> Outside Europe the maintenance of her imperial communications and the interests of the dominions, colonies, and dependencies become dominant. But for India and the dominions of Australia and New Zealand, there would have been no British occupation of Egypt, no reconquest of the Sudan for civilization, and the great work accomplished by Lord Cromer and his assistants would have remained unattempted. The fact that Egypt commands in the Suez Canal the main artery of communication between England on the one hand and India and Australasia on the other is what took us to Egypt and keeps us there. We cannot afford to see Egypt and the canal dominated by another country any more than the United States could tolerate the domination of the Panama Canal by a foreign power. We cannot therefore allow abuses or disorders to arise in Egypt which would justify or excuse foreign intervention; but, subject to this over-riding necessity, it is the policy of Great Britain to leave the management of Egyptian affairs as far as possible to the Egyptians themselves, and to confine our interference to the defense of our vital interests and the discharge of our obligations to other nations to whom we have formally declared that we should regard any interference by them in the internal affairs of Egypt as "an unfriendly act" and "any aggression against its territory as an act to be repelled with all the means at our command."
>
> In the Sudan the conditions are somewhat different. We were responsible for its reconquest from the devastating tyranny of the Mahdi and his successors, and we pledged our word to its people that the old misrule of the pashas should not be restored. Here, therefore, we have a direct and immediate responsibility to the people themselves for the form and character of their government, and we claim and exercise the power necessary to fulfil our pledge. The condominium has been maintained. The British and Egyptian flags are hoisted together over the government buildings at Khartum, but since the murder of Sir Lee

Stack, Egyptian troops and officials have been withdrawn and all effective control has been in British hands.

Passing to the Near and Middle East, we find that here also the permanent basis of British policy is fixed by the existence of the Indian Empire. No British government desires to extend its liabilities in the Red Sea, the Persian Gulf, or on the shores of the Indian Ocean, and, indeed, in Iraq we are reducing them as rapidly as the circumstances of the case and our mandatary obligations to the League of Nations admit; but the safety of our communications is vital to us. With no aggressive intentions ourselves, we shall be content if no other power cherishes aggressive designs. Our interest lies only in the maintenance of peace and of the *status quo*.

The remainder of the article deals chiefly with British policy in the Far East and China, where more than anywhere else it is that of "a nation of shopkeepers," interested in the Open Door and a strong central government; and lastly, British policy toward the United States, on which he remarks that no British government will ever command popular support "which is thought for a moment needlessly to jeopardize the good relation of the two peoples."

EUROPEAN POLITICS

REPUBLICANS CARRY SPANISH ELECTIONS.—The election of a national Constitutional Assembly in Spain, held on Sunday, June 28, resulted in an overwhelming victory for the moderate Republican—Socialist *bloc* which supports the new Spanish republic. Of over 1,000 candidates not more than twenty were professed monarchists, and of these not more than five were elected. The new assembly, which has 467 members—one for each 50,000 population, was called to open on July 14. A draft constitution has been prepared by the Zamora cabinet which provides for a republican government somewhat like that of France, with a president elected for six years, a bicameral legislature in which the senate would represent "cultural, industrial, and labor entities," and a centralized government at Madrid, though with opportunity for autonomy in provinces where a three-fourths majority so desire.

The chief setback to the new republic, and especially to the plan of a centralized administration, was the sweeping victory of the Separatist leader Colonel Francisco Macia in Catalonia, whose party was reported to have won forty-two out of a possible fifty-three seats from that province. Macia's aim is not for complete separation, but for a federated state in which Catalonia would have freedom in all but name.

The new Spanish Ambassador to the United States, the distinguished student and political writer, Salvador de Madariaga, was elected deputy from Corunna, but it appeared unlikely that he would leave this important post for a seat in an assembly completely dominated by the present government.

EXILE OF CARDINAL SEGURA.—The difficulties between Cardinal Segura, Primate of Spain, and the Spanish republic resulted on June 15 in the forced expulsion of the primate from the country. Cardinal Segura visited Rome in May after conflicts with the government, but is said to have returned secretly, and engaged in monarchical propaganda for which he was expelled as a "danger to public safety." At the time of writing the government had made no reply to the formal protests of the Vatican.

ITALO-VATICAN CRISIS.—At the close of June the controversy between the Italian government and the Vatican over the government suppression of Catholic action societies in Italy appeared little nearer solution. In a note of June 24 the government agreed to enter into negotiations over the interpretation of Art. XLIII of the Italo-Vatican Concordat, which extends protection to church organizations, but at the same time declined to withdraw the restrictions on the societies as a preliminary move. The government's contention was that the political activities of the societies excluded them from protection under the treaty. Objection was also raised to the alleged efforts of the Vatican to enlist support and sympathy from abroad in the quarrel with the Italian state. A Vatican note of July 1 accepted the proposal for negotiations, while still demanding apologies for the anti-Catholic incidents and denying the political activities of the church societies.

FRANCO-SOVIET TRADE PACT.—During June negotiations at Paris for a trade agreement between France and the Soviet republic were reported to have progressed favorably, the best promise of success lying in the eagerness of French industrial leaders

to secure the orders amounting to over $64,000,000 which Soviet negotiations have dangled as a bait. Purchases to this amount in machinery, shipping, metals, and textiles would go far toward easing the present slump in French export trade. Agreement hinges upon the willingness of French banking interests, with government support, to give absolute guarantees extending from two to five years of the credits which must be extended to Russia to cover the purchases. The Soviet government also hopes to secure from France assurances for the entry of her goods on most-favored-nation terms.

BRUENING BALKS REICHSTAG SESSION.—On June 5 President von Hindenburg of Germany signed the new series of emergency tax ordinances by which it is hoped to bring an increase of from $400,000,000 to $500,000,000 in German revenue. There were fears that the government might be forced to face a special session of the Reichstag to pass on the new measures, since under the constitution a session must be called upon the demand of one-third of the Reichstag members. When the question came up, however, in the Reichstag steering committee, Chancellor Bruening forced an adverse vote by the threat that he and his cabinet would immediately resign if the session were called.

AUSTRIAN CABINET CHANGES.—In the midst of its negotiations—at least temporarily successful—for pulling the Austrian Credit Anstalt out of its financial difficulties, the Ender cabinet in Austria resigned on June 16. The chief cause of the upset was apparently divergences within the cabinet over the extent to which government credits and guarantees should be used in supporting the bank. As was expected, the Ender ministry soon returned to office, with its make-up only slightly changed.

It was considered a victory for forces favoring Austro-German rapprochement that British rather than French banking interests should have come to Austria's assistance in her present financial straits. French aid was conditioned on various political guarantees, and the support from the Bank of England was taken as indicating a willingness on the part of England to curb French dictation in Austrian affairs.

UNITED STATES AND LATIN AMERICA

AMERICAN STATESMEN ABROAD.—The visit of Secretary of the Treasury Mellon to Europe in June was at first said to have no political significance, but his reports from abroad were an important influence leading to the President's debt moratorium proposals, and thereafter Secretary Mellon figured prominently in the conversations at Paris to reconcile the French and American points of view. Similarily the European tour of Secretary of State Stimson is likely to take on greater importance than at first indicated, in view of the extent to which the United States is involved in the settlement of European economic problems, and the interest attached to his visit in European capitals. The Secretary was expected to reach Naples on July 7, and after conferences in Rome, to proceed to Paris by the middle of July.

ARGENTINE TRADE.—In a series entitled *Studies in World Economy*, published by the Carnegie Endowment for International Peace, the latest issue is on *International Competition in the Trade of Argentina*, by Prof. R. C. McCrea of Columbia University. From the mass of figures, Professor McCrea works to the conclusion that American and British trade in the Argentine are only in small measure in competition with each other. This conclusion is reached, however, only by assuming that, in the case of half the American exports, British competition is impossible because of her inferior methods of production. Of the British Trade Exposition of March, 1931, he declares the results of little real commercial value, considering the cost of $30,000,000, of which at least $10,000,000 must be counted as loss. He writes:

> From its inception the purpose of the exposition has been clearly to attack American mercantile supremacy, or what the British term the American monopoly in Argentine trade. Apparently, it is difficult to face the facts. One quarter of American exports to Argentina are goods that are not and cannot be produced in England; two quarters consist of goods that England's present industrial organization is manifestly not equipped to manufacture at competitive prices and which England cannot compete in unless she first completely revolutionizes her entire social and economic structure; while only from 14 to 28 per cent of the trade can be considered in any way open to British rivalry. In other words, United States exports to Argentina have grown, not by taking trade away

from England, for British trade has likewise increased, but by developing new lines of manufacture and production whose products are bought by England herself and by the British dominions.

AMERICAN ARMAMENT FIGURES.—The American State Department on June 14 set an example of publicity for armament figures by giving to the press the full text of the 32-page report sent to the League secretariat on the strength of the United States land, naval, and air forces. The report was in reply to a request for data to be laid before the coming conference on limitations of armaments.

FAR EAST

OPERATIONS AGAINST BANDITS.—With his position assured by his reëlection as chairman of the executive Yuan at Nanking (in effect president), and the election of Finance Minister T. V. Soong as vice chairman, General Chiang Kai-shek left Nanking on June 18 to assume personal command of the military forces mobilized to attack banditry south of the Yangtze. The government troops were estimated at upwards of 500,000, while in Kiangsi province there are in the neighborhood of 300,000 banditry. The government plan of campaign, it is reported, is to avoid efforts to encircle the rebels, which have failed in the past, but rather to drive them southward into Kwantung, where they will constitute a menace to the rival government established at Canton.

The concentration of Nanking troops south of the Yangtze was facilitated by a supporting movement of Manchurian forces southward from Mukden into the Peiping area, there being now 200,000 Manchurian troops south of the Great Wall, Marshal Chang Hsueh-liang maintains his headquarters at Peiping, but expects to spend two-thirds of his time in his Manchurian capital. That the Mukden-Nanking alliance is bona fide at least for the present seems evident from the consent of Mukden to the establishment of seven district headquarters of the Kuomintang in Manchuria.

THE CANTON FACTION.—The rival government set up at Canton was busy during June importing six months' supply of munitions and gathering funds by special taxation and seizure of customs money at all ports within reach. Prominent in the Canton cabinet, or "Council of Sixteen," is Eugene Chen, Jamaica-born lawyer and editor who was foreign minister of the old Canton government of 1926 which extended its control northward over all China, and Sun Fo, son of the great Sun Yat-sen and until recently minister of railways at Nanking. Dr. Chao-Chu Wu, Chinese minister to the United States, resigned from his post on June 6, expressing his general sympathy with the southern faction.

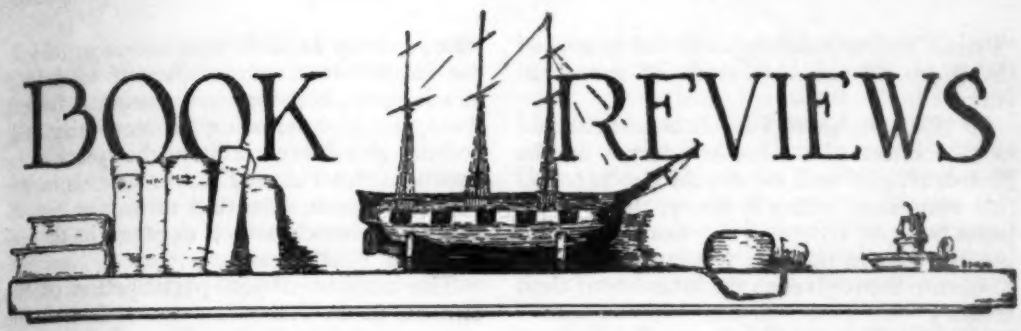
MISCELLANEOUS

"FOREIGN AFFAIRS" FOR JULY.—Aside from Sir Austen Chamberlain's article, summarized elsewhere in these notes, the discussions of chief naval interest in the July number of *Foreign Affairs* are "Wanted, a Consistent Latin American Policy," by Norman H. Davis; a review of General Pershing's *Memoirs* by Major General Sir Frederick Maurice; "The Disarmament Puzzle," by Allen W. Dulles, American legal adviser at the Geneva Naval Conference; and "Oil, Great Britain and the United States," by Arthur C. Veatch, prominent petroleum geologist.

Worthy of quotation, perhaps, is General Maurice's remark, apropos of General Pershing's contention that the availability of even a small American Army in the spring of 1917 would have been decisive:

> If Great Britain had been able in August, 1914 to place 250,000 men on the left of the French Army instead of the 100,000 which she sent to Mons, and had declared her intention of supporting France and Belgium if they were attacked by Germany, the World War would almost certainly not have taken place as and when it did take place, though it may be doubted whether in the existing state of Europe it could have been postponed indefinitely. These are matters on which those concerned with the grave and complex problems of the limitations of armaments will do well to ponder. While I believe it to be true that unrestricted competition in armaments is a cause of war, history tells us clearly that neglect to prepare for war has in the past been frequently a cause both of war itself and of its prolongation. It is the difficult task of the world's statesmen to try to arrive at a just balance between blatant aggressive militarism and the neglect of necessary precautions.

BOOK REVIEWS



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THE ROYAL MARINE ARTILLERY. By Edward Fraser and L. G. Carr-Laughton. Whitehall, S. W. London: The Royal United Service Institution. 2 vols. 1930. 3 guineas.

REVIEWED BY BRIGADIER GENERAL DION WILLIAMS, U. S. MARINE CORPS.

Although the history of the British marines dates back to the establishment of the "Lord High Admiral's Regiment" in 1664, it was not until much later, in 1804, that the Royal Marine Artillery was established. This establishment of an artillery branch of the strictly naval military force was due to the representations made to the Admiralty by Admiral Nelson in the Mediterranean fleet and by the admiral commanding the Downs Squadron watching Napoleon's invasion flotilla off Boulogne, that the land artillery detachments temporarily assigned to handle the armament of the bomb vessels were unsatisfactory as to discipline and efficiency.

Thus the Royal Marine Artillery was born one year before Nelson wrote his name high on the roll of fame at Trafalgar. From this date until the date 120 years later when changing conditions in the British Navy dictated the amalgamation of the Royal Marine Artillery with the Royal Marine Light Infantry into the present corps of Royal Marines the history of the Royal Marine Artillery has been closely interwoven with that of the Royal Navy, and in all the operations of that period in which the Navy participated the Royal Marine Artillery played an important part.

From 1804 until about 1890 the R.M.A., and the R.M.L.I. likewise, formed a part of the marine detachments of all of the ships of the British Navy, whether the ship was great or small, but in the latter year a change in policy limited the service of the marines to first-class ships and flagships, in addition to certain ships assigned to special missions where marines were particularly desirable.

From 1804 to the last part of the nineteenth century the ships of the British Navy saw much service in various parts of the world protecting British interests and nationals and their properties in the unstable countries of the world where the might of Britain was represented by the man-of-war flying the red cross of St. George on the white field as its emblem of power. The suppression of pirates who preyed upon the peaceable merchantmen that sailed to the far lands, the control of the slave trade that thrived along the African coasts and in the Pacific isles, and the protection of the religious and commercial missionaries of Great Britain in distant lands where government was vague gave frequent opportunity for the "landing of marines," and much of the history of the corps touches on such adventure.

As a matter of course the British Navy took first place in every war that involved Great Britain or its far-flung dependencies, and in all of these operations the Royal Marines played their gallant part on sea and on land, and thus gave rise to their motto, *Per Mare Per Terram*, which they proudly wear to tell the world their field of action.

The history of the British Navy is the best part of the history of Great Britain and the details of the gallant exploits of

"Britain's Sea Soldiers" enliven many of the pages of the epic story of her great Navy.

In 1879, the great Earl Beaconsfield said in the course of a notable address on the British Navy, "and we should also recollect that connected with the Navy, there is the finest body of troops in the world, and that is those gallant marines who are ever ready to devote themselves to the interests of their country."

With such a wealth of material to draw upon it has been no easy task for the authors to write the life story of the Royal Marine Artillery, for with such a superabundance of riches at hand it was no easy task to sort over and select only enough to fill the book with the most interesting details. A perusal of the two fine volumes will show how well the authors have completed their task and will amply repay the student of naval or military history or the casual reader in search of tales of daring and adventure.

The first chapters describe with much detail the organization of the Royal Marine Artillery in the years immediately following its establishment, giving especial prominence to the letter of Lord Nelson on the subject. Then follow accounts of the participation of the force in the Napoleonic wars, with interesting chronicles of the passage of the Dardanelles, the bombardment of Copenhagen, the bombardment of the Russian fleet at Port Baltic, the siege of Rosas, the part taken by the R.M.A. in the Peninsular campaigns of Wellington, from Torres Vedras to the capture of Salamanca.

Five chapters of the book tell of the experiences of the R.M.A. from 1813 to 1815 in what the authors designate as the "American War," which is better known in the United States as the "War of 1812." Many landing operations along the coast of the United States are covered, as well as operations along Lake Champlain, the battle of Lundy's Lane, the siege of Fort Erie, the Plattsburg campaign, and the operations in the Chesapeake which preceded and led up to the capture of the city of Washington in August, 1814. The story of the fight between the British ships under Admiral Cochrane and the United States ships under Commodore Barney in the Patuxent is told in detail from the beginning to the day when Barney landed from his ships to join the shore forces in an attempt to defend Washington, blowing up his ships as he left them. It is interesting to note that the authors give more credit to the treacherous shoals of the Potomac River as aids to the American cause than they do to the American naval vessels which engaged in the defense of Washington.

The account of the participation of the R.M.A. in the American war ends with the story of the battle of New Orleans, the battle fought after peace was declared and long heralded as the greatest victory of the war for the American side.

Interesting pages are filled with tales of the prowess of the British marines in wars now almost forgotten, the bombardment of Algiers, 1816, war episodes in the Ashantee campaign, in Greece, against the Turks in the Levant, on the Spanish coast in the Carlist war, the Syrian war of 1840, the Parana River expedition in South America in 1845, services in what are designated as the first, second, and third China wars bring us down to the Russian war in the Crimea in 1854-56, in which the R.M.A. took an active and honorable part winning fame, medals, and long casualty lists.

Operations of the British Navy in China and the part taken therein by the marines fill many pages, from the walls of Canton in 1857, through Tientsin and the Peiho in 1860, the Taiping rebellion in 1861, to the Boxer campaign in 1900, and on many occasions the British marines were engaged side by side with the American marines, thus laying the foundation for a friendship between the two services which is cordial and active today.

In the Zulu war of 1879 the R.M.A. gained more knowledge of the fighting ability of the tribesmen and this was increased between 1882 and 1899 by numerous engagements incident to the Egyptian campaigns.

The period from the Boxer war in China, 1900, to 1914 saw a comparative cessation in the small campaigns in distant lands and gave opportunity for much training and experimentation with new weapons, all of which proved of great value in the World War which taxed the military power of Britain to the "maximum effort" limit from 1914 until Armistice Day in 1918.

During the World War the Royal Marine

Artillery, in common with all of the established naval and military branches of the British services, was greatly increased, and thus augmented, the corps fought by sea and land on every front, with the landing force at the Dardanelles, along the stormy West front, with the battle fleet at Dogger Bank and Jutland, with the cruiser fleet at Falkland Islands, in the forlorn hope assaults at Zeebrugge undertaken to close the channel to the use of the German submarines, wherever the British flag was unfurled facing the enemy on land or sea.

Long accustomed to service in "little wars," that tax the skill and courage of the small forces engaged but usually receive scant notice in history, the R.M.A. saw service in German Southwest Africa in 1915, German East Africa in 1916-1917, and when the Armistice ended the fighting on the long fronts from the English Channel to the Dardanelles in 1918, the Royal Marines hastily packed their kits and were off to the far north of Europe to aid the White Finns in their struggle against a Russia gone Bolsheviki.

It is noted that owing to the many extraordinary demands made upon it during the World War the corps of Royal Marines expanded threefold, from 18,234 to 55,603, or in a fixed ratio to the strength of the Royal Navy during the same period of stress. Peace again established, the demands for reduction in expenditures made large inroads into this strength and by 1923 the corps was back to its pre-war strength.

The immense expense of four years of a maximum effort war had left the government of Great Britain with a heavy burden of war debt and retrenchment in every direction was the order of the day, the heaviest retrenchment being directed, as is too often the case after war's alarms are stilled by peace, toward reduction of the armed forces by whose superhuman efforts an honorable peace had been won.

As a result the King, as colonel-in-chief of the Royal Marines, under date of June 22, 1923, ordered the amalgamation of the two historic branches of the Royal Marines, the Royal Marine Artillery and the Royal Marine Light Infantry, into one corps to be styled "The Royal Marines." The former duties of the two branches are to be carried on in the future by the personnel of the corps.

As a result of this amalgamation the scarlet tunics of the Royal Marine Infantry, which gave them the name of the "Red Marines," have disappeared and the personnel of the Royal Marines now wear the blue tunic with scarlet facings, similar to the blue tunics which gave the Marine Artillery the name of the "Blue Marines." Likewise the badges of the bugle for infantry and grenade for the artillery have been abolished and the whole corps now wears the "Lion and Crown" that has long been a mark of the British "Tommy Atkins."

The Royal Marine has ever done his duty well in war or in peace and is ever ready to accept philosophically the decrees of the King, who is both his sovereign and his commanding general, and this trait was well worded in an editorial in the *Globe and Laurel*, the official organ of the corps of Royal Marines, reading as follows:

> Reduction in the armed forces of the Crown has invariably followed great wars, and our corps has been no exception to the rule. Our numbers have always risen in time of war and fallen in time of peace. We have always survived the process and will survive it again; but we must now be prepared to face a period of small establishments, and slow promotion, with pride in our past and faith in our future.

The history is profusely illustrated with a wealth of pictures, maps, and plans, culled from the many records of the achievements of this famous corps during the 120 years of its very active life from 1804 until 1923. The text and illustrations combine to make it a magnificent record of a magnificent corps.

NICHOLLS'S SEAMANSHIP AND NAUTICAL KNOWLEDGE. By Captain Charles H. Brown. Glasgow: Brown, Son & Ferguson, Ltd. 1931. 15s.

REVIEWED BY COMMANDER F. P. CONGER, U. S. NAVY

This volume of nearly 600 pages was written primarily for the purpose of preparing mates and masters of the British merchant service for examinations in their various grades. There is little doubt but that the book has been correctly entitled especially with the addition of the words "and Nautical Knowledge." This addition may obviously cover a wide range of subjects any or all of which might correctly be included under nautical knowledge. In this volume, how-

ever, the author appears to have made a very careful choice of those most useful subjects so closely affiliated with the art and practice of good seamanship.

We, therefore, find very concise and complete chapters on parallelogram of forces, mensuration, hydrostatics, ship construction, navigation, and stability and trim. In addition there are several pages given to the description, management, and operation of boilers, turbine and reciprocating engines, and to all other deck and auxiliary machinery normally found on board a merchant vessel. While one would be apt to classify these under the general headings of mathematics and engineering, rather than seamanship, the author has, by their insertion in the proper places proved their usefulness very conclusively to the seaman seeking nautical knowledge. A careful perusal of this volume from cover to cover by all sailormen would seem to preclude the possibility of a truthful repetition of the traditional story of the master and the chief engineer who continually quarreled over which occupied the most important position aboard ship. Having agreed to an exchange of positions on one occasion the master later reluctantly called the bridge informing the chief that "he couldn't get his blankety blank engines started," whereupon the chief casually replied that it didn't make any difference, he didn't need the engines anyway as they were "hard aground on a sand bar."

The chapters on all subjects ordinarily classified under seamanship, and found in all standard works, are thorough, clearly and concisely worded, and arranged with numerous excellent sketches and illustrations throughout the book.

Of interest to naval personnel is the fact that while the word "helm" has been abolished from our own service, the author states in his text "The helm has disappeared from ocean-going ships but the name still survives and only the rudder remains the same." However, further on he states "The word helm for some unexplained reason is still retained and the board of trade (British) has intimated that from June 30, 1931, helm or steering orders to the steersman shall be given in the direct sense, e.g., when the ship is going ahead an order containing the word 'starboard' or 'right' or any equivalent of 'starboard' or 'right' shall only be used when it is intended, on ships as at present generally constructed and arranged, that the wheel, the rudder blade and the head of the ship shall all move to the right."

In sharp contrast to our own standard textbook, Knight's *Seamanship*, there is in the volume practically a complete absence of any reference to the British Navy, naval vessels, terms, customs or practices of the naval service. The single exception is made in the page and a half devoted to "instructions for the recovery and safe handling of torpedoes lost from H.M. ships." This is very useful information and might well be imparted to our own merchant service officers.

Since this volume was primarily compiled for the education of merchant marine officers, the absence of information on naval vessels is not surprising. Its purpose is clearly stated and with the addition of questions and answers pertaining to the text, arranged at the end of each chapter, the author has covered the subject matter in a thorough and comprehensive manner, thus providing his readers with knowledge for which they will always find a ready application on board a merchant vessel.

The book has added a great deal to the modern seaman's knowledge of the whatnots of a ship. It has missed few details from the beginning to end, keeping the reader not only conversant with, but particularly alive to the requirements of the merchant service. One particular point stressed is the attention to lifeboats, the equipment of each, and the beneficial use of sails. There is no exaggeration in saying that if the British merchant officers had had access to Nicholls's chapter on sailing equipment of lifeboats, many lives might have been saved during the World War. Sailing, instead of rowing their lives away, saved many survivors of torpedoed vessels in the big war.

As a valuable addition to a seaman's useful library it is practically unsurpassed. No captain of a merchant vessel could lose prestige or reputation by carrying out all the practical orders set forth in this volume.

AERIAL AND MARINE NAVIGATION TABLES. By Lieutenant J. E. Gingrich, U. S. Navy, New York: McGraw-Hill Book Co. 1931. $2.50.

REVIEWED BY LIEUTENANT COMMANDER P. V. H. WEEMS, U. S. NAVY

Disregarding possible small errors in setting Ogura's *Altitude Tables* in type anew,

the tables as arranged are neat in appearance, accurate, and extremely facile in use. As they now stand, and ruling out tables which require interpolation, these tables furnish the easiest, simplest, and most satisfactory method for laying down the line of position where the azimuth is to be computed rather than taken from a diagram such as Rust's *Azimuth Diagram*. The Rust diagram is slightly faster to work, but when the altitude alone is required, Ogura's *Altitude Tables* without the azimuth tables are of course the more direct.

Lieutenant Gingrich cleverly combines the five tables of Ogura's method into three neat tables thereby saving an extra book opening. In addition he includes convenient auxiliary tables and makes use of the following sensible wrinkles:

(a) He utilizes both cover pages, and the two pages facing them.
(b) In table B the type alternates heavy and light, making it easy to pick out the values.
(c) He includes a clever method for finding the meridian altitude.
(d) He includes an easy method for finding the great circle course and distance.
(e) He had the nerve to omit the usual long explanation of how to use the table to identify stars. The table will, of course, solve all triangles within the limits of its arguments, yet it would weaken the book to include more things than it will do efficiently. The Rude *Star Finder* should be used for star finding.
(f) The explanation and illustrations are in large type and are exceptionally good.

In the preface Lieutenant Gingrich generously credits those who have helped him. Particularly does he give full credit to Dr. Ogura, the original author of the tables. Some Americans appear to feel that only partial credit is due Dr. Ogura for his splendid contribution to the art of navigation in devising these tables. They mention the fact that similar formulas were mentioned in 1854 by Chauvenet, and that similar tables were long ago published by Souillagouet in France, and by the Russian Hydrographic Office. The latter used the method of the astronomer, B. E. Fuss, as computed under the direction of the astronomer, F. F. Vitram. The fact is, there is honor enough to go round.

Lieutenant Gingrich had the good judgment to see the advantages of Ogura's tables and added his bit by combining them in such a way that they will appeal to the practical navigator.

Ogura's original tables were in the form:
(a) For altitude—$A + B = \log H$, with one combination of K and Dec.
(b) For azimuth—$D + E = \log Z$.

There were two tables for the altitude, and three tables for the azimuth. Lieutenant Gingrich combined two of the azimuth tables with one of the altitude tables making a total of three tables and four book openings for finding both the altitude and the azimuth, which is only one book opening for finding the azimuth.

The particularly valuable features of the book are:

(a) No interpolations for an accuracy within 1′ for altitude, and 1° for azimuth. For greater accuracy, a short interpolation is required for both altitude and for azimuth.
(b) Brevity of tables. All three tables are included in fifty-one pages.
(c) Freedom from troublesome cases. There are no cases for finding the altitude, and only one case which differs from the rule for finding the azimuth. This case is when the hour angle exceeds 90°, name X like the latitude.
(d) The azimuth is found with t, d, and L as arguments, and is therefore independent of the altitude, and may be used for compass control.

The binding is semiflexible leatherette. The size of the book is 7 1/8 × 10 11/16 × 5/16 inches. The dimensions might easily be reduced by a half to three-fourths of an inch, and this would add to the handiness of the book.

At least eight blank or nearly blank pages could be omitted, and this would add considerably to the handiness of the book. It is difficult to persuade publishers to digress from the standard border and make-up of a book, yet the navigator is interested more in the facility of use than in the artistic appearence.

By a coincidence, the reviewer received only a few days ago specifications for a suitable book for the air navigator by an Englishman. These requirements appear to be

met in the *Aërial and Marine Navigation Tables.* P. F. Everitt, includes among other interesting data in his article, "Tables for Use in Aëro-Navigation by Astronomical Methods," which appeared in the *Journal of the Royal Aëronautical Society,* a comparison between the following methods:

Goodwin's *Alpha Beta Gamma Tables*
Aquino's *Tables* (two methods)
H. O. 208
Line of Position Book
Smart and Shearme's Tables (Inman)

He goes into detail on the method for finding the azimuth and prefers the *A.B.C. Azimuth Tables* to any other method. He writes:

> The use of the *A.B.C. Azimuth Tables* is so simple, and they occupy so little space, that they are to be clearly preferred.
>
> On balancing up the advantages and disadvantages of the various tables the writer considers that the aëro-navigator will at present be best served by using Weems's *Line of Position Book* for altitudes, together with the *A.B.C. Azimuth Tables;* the latter could be taken out and rebound either separately or with the Weems' tables to form either two or one thin books which will contain all he requires both for position line work or compass error observations. The convenience of use is very great, the precepts to be remembered are a minimum, and the necessary tables of refraction, parallax, etc., are already printed in the Weems book.

Mr. Everitt describes Lieutenant Gingrich's book in advance. The latter uses most of the auxiliary tables from the *Line of Position Book,* and dovetails the *A.B.C. Azimuth Tables* neatly with Ogura's unexcelled tables.

There is an apparent disadvantage in the fact that the declination for computing the azimuth is carried only to 65°. However, this disadvantage is more apparent than real, since but few stars (and these are faint ones) fall outside this limit. The blue azimuth tables for instance go to only 70°.

On the whole, both author and publisher deserve every credit for the excellent book they have produced.

THE AMERICAN BLACK CHAMBER.

By Herbert O. Yardley. Indianapolis: Bobbs-Merrill Co. 1931. $3.50.

REVIEWED BY REAR ADMIRAL ELLIOT SNOW (C.C.) U. S. NAVY (RETIRED).

A short time prior to the appearance in June, 1931, of *The American Black Chamber,* an unimpeachable authority on cryptography—one who has made it his life work—vouchsafed the following opinion of Major Yardley's book: "It is rather sensational and anyone interested in the subject will wonder!"

Curiously enough the real and substantial contribution that this book makes to cryptography was buried under sensational headlines, by a great eastern daily paper. When mentioning the appearance of this book, the following startling headlines were used:

"Plot to kill Wilson in Paris is charged!"

The book is sensational, i.e., suited to excite great interest, but it is far more than that—the selection of those headlines "Plot to kill Wilson" falls well under that category. It is the most astounding and interesting disclosure of some of the innermost secrets of the great World War, as it deals with the breaking down and exposure of messages sent by code, cipher, and secret writing.

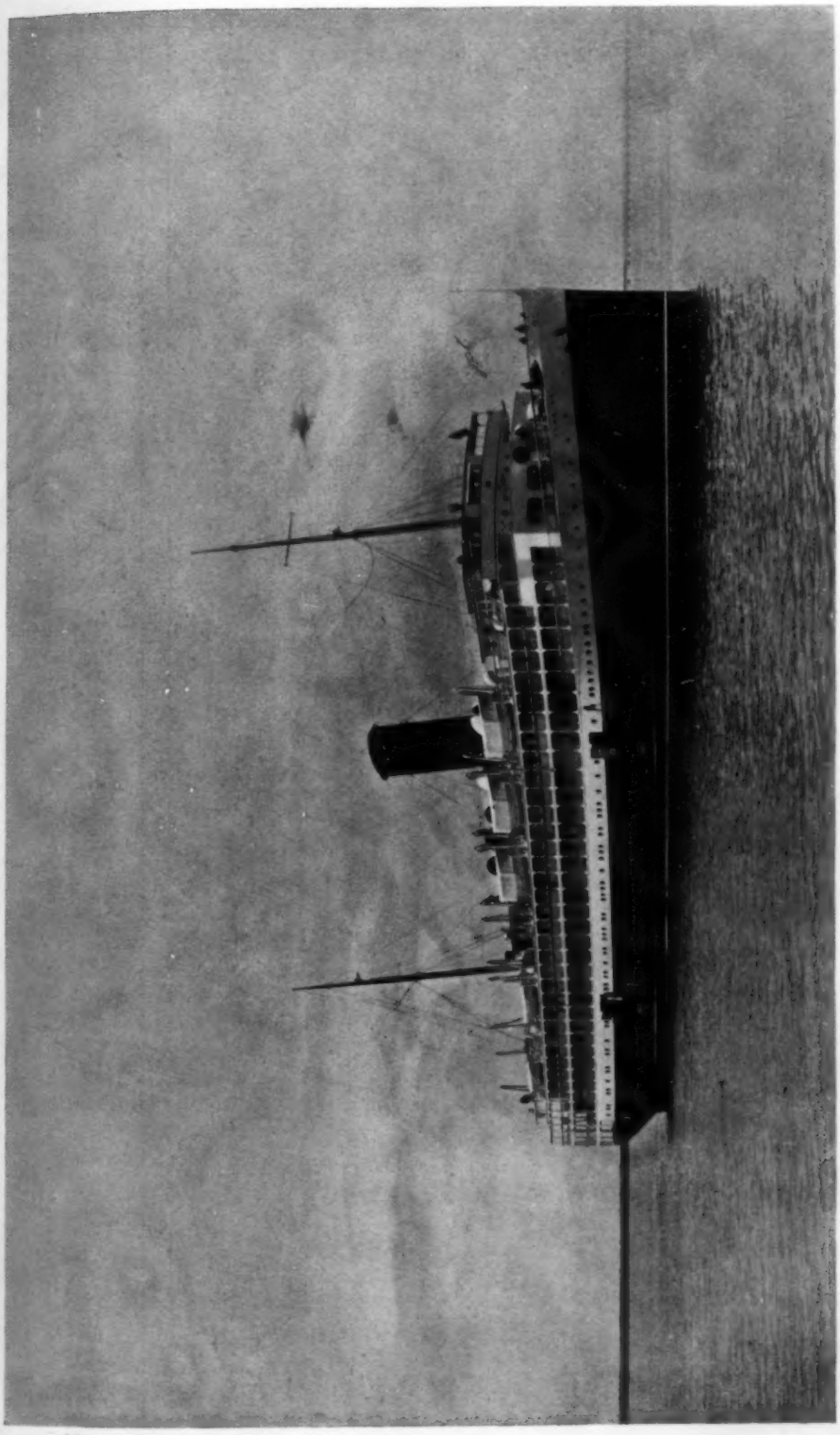
The book also is not without its humorous incident. A case in point being that of a Mexican general who, to make sure that his messages would be correctly deciphered, even sent the key to it!

Great courage was exhibited in thus making known some of the author's work. And the author very wisely placed the following footnote at the end of the chapter on "Soviet Spies":

> Soviet agents please note. Yes, I once had copies of these documents, but I don't care to have my throat cut and do not plan to publish them. In fact they have been destroyed. So be reasonable.

Of the many interesting illustrations—nearly fifty in all—none will attract more attention and excite the generous sympathy of the reader, than the splendid face of Lather Witcke, alias Pablo Waberski, "the only German spy in America during the World War who received the death sentence."

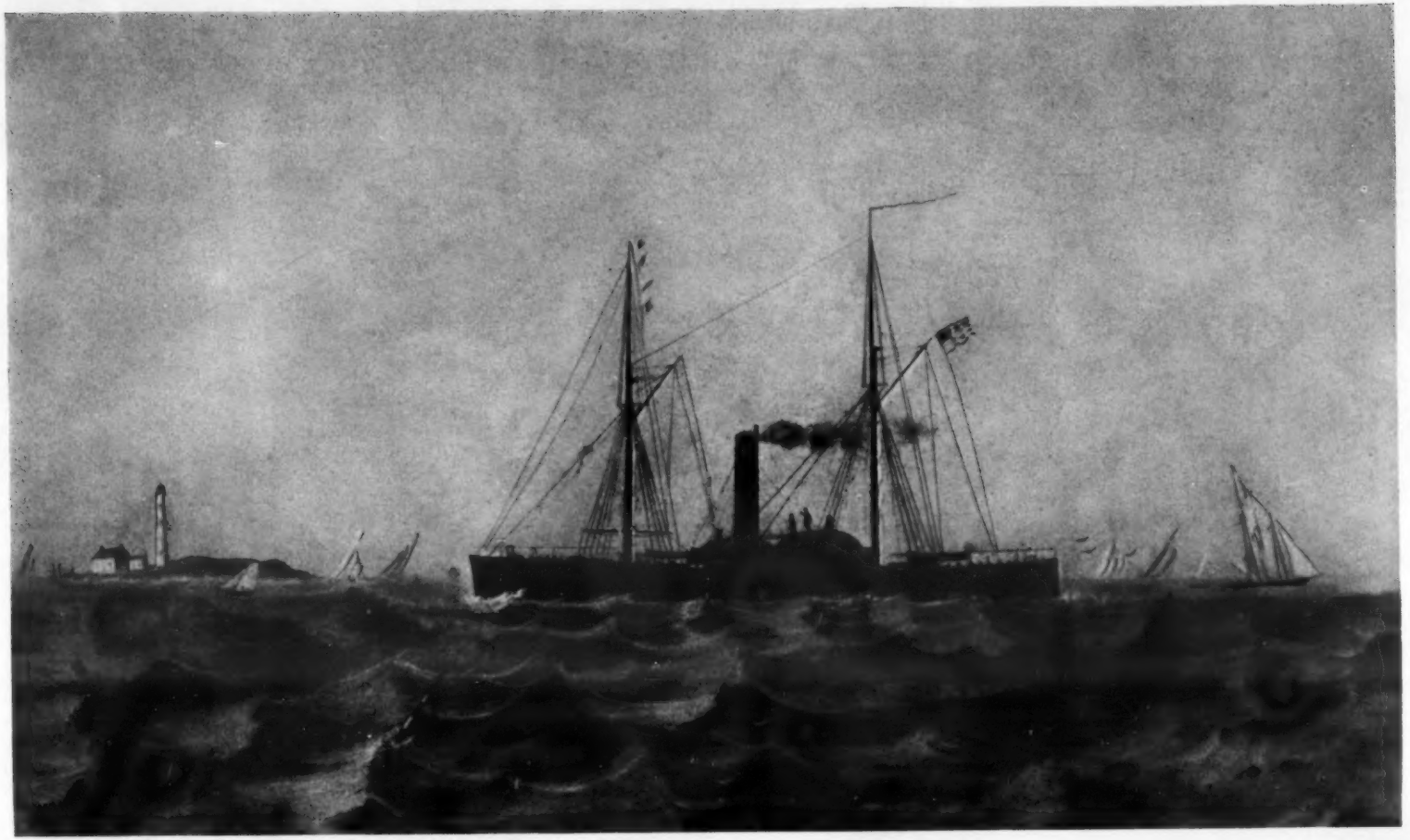
There are disclosures in this remarkable book which will cause many government officials "to think furiously." And some private individuals who are concerned will be interested as well as the general reader. In all likelihood copies of *The American Black Chamber* will soon find their way into the hands of all "Black Chambers" throughout the Occident and Orient.



Courtesy Newport News Shipbuilding & Dry Dock Co.

SS. FLORIDA

She was recently completed for the Peninsular and Occidental Steamship Co.



Courtesy Naval Historical Foundation (From an oil painting by a naval officer.)

U.S.S. *PAUL JONES*

This painting was formerly owned by Charles H. Taylor, of the Boston *Globe*, and was presented by him to the Naval Historical Foundation.

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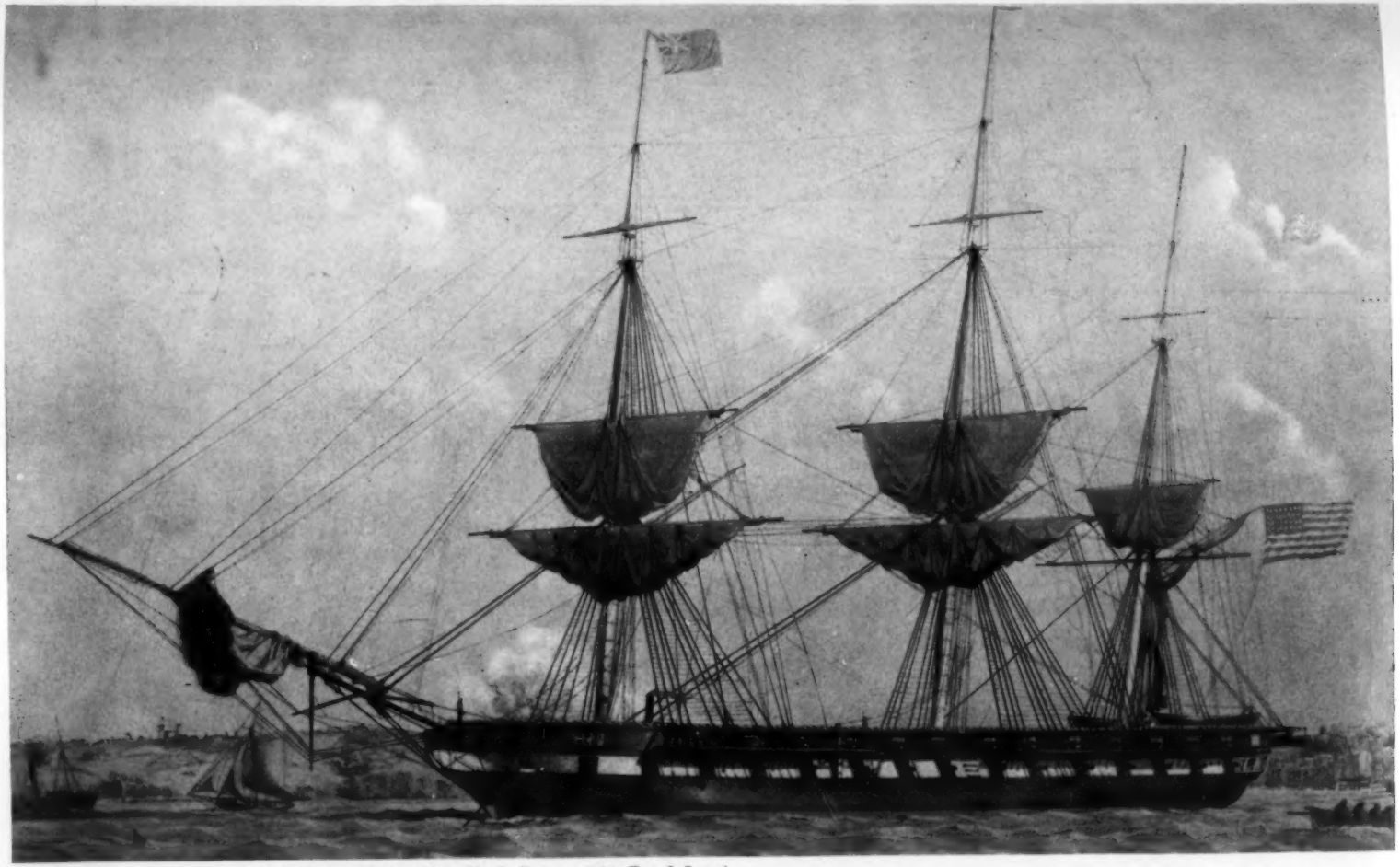


Courtesy Naval Historical Foundation (From a lithograph by T. G. Dutton, 1851. Day & Sons.)

U.S.S. *ST. LAWRENCE,* 50 GUNS, SALUTING OFF OSBORNE, ISLE OF WIGHT

This was published May 5, 1851, by Ackerman & Co., London, and was presented to the Naval Historical Foundation by Charles H. Taylor, 1931.

Courtesy Chance Voughs Corporation

FINAL ASSEMBLY DEPARTMENT OF THE NEW PLANT OF THE CHANCE VOUGHT CORPORATION, HARTFORD, CONN.

Courtesy Chance Vought Corporation

FINAL ASSEMBLY DEPARTMENT OF THE NEW PLANT OF THE CHANCE VOUGHT CORPORATION, HARTFORD, CONN.

Courtesy Chance Vought Corporation

VOUGHT MODEL O3U-1 WASP CORSAIRS

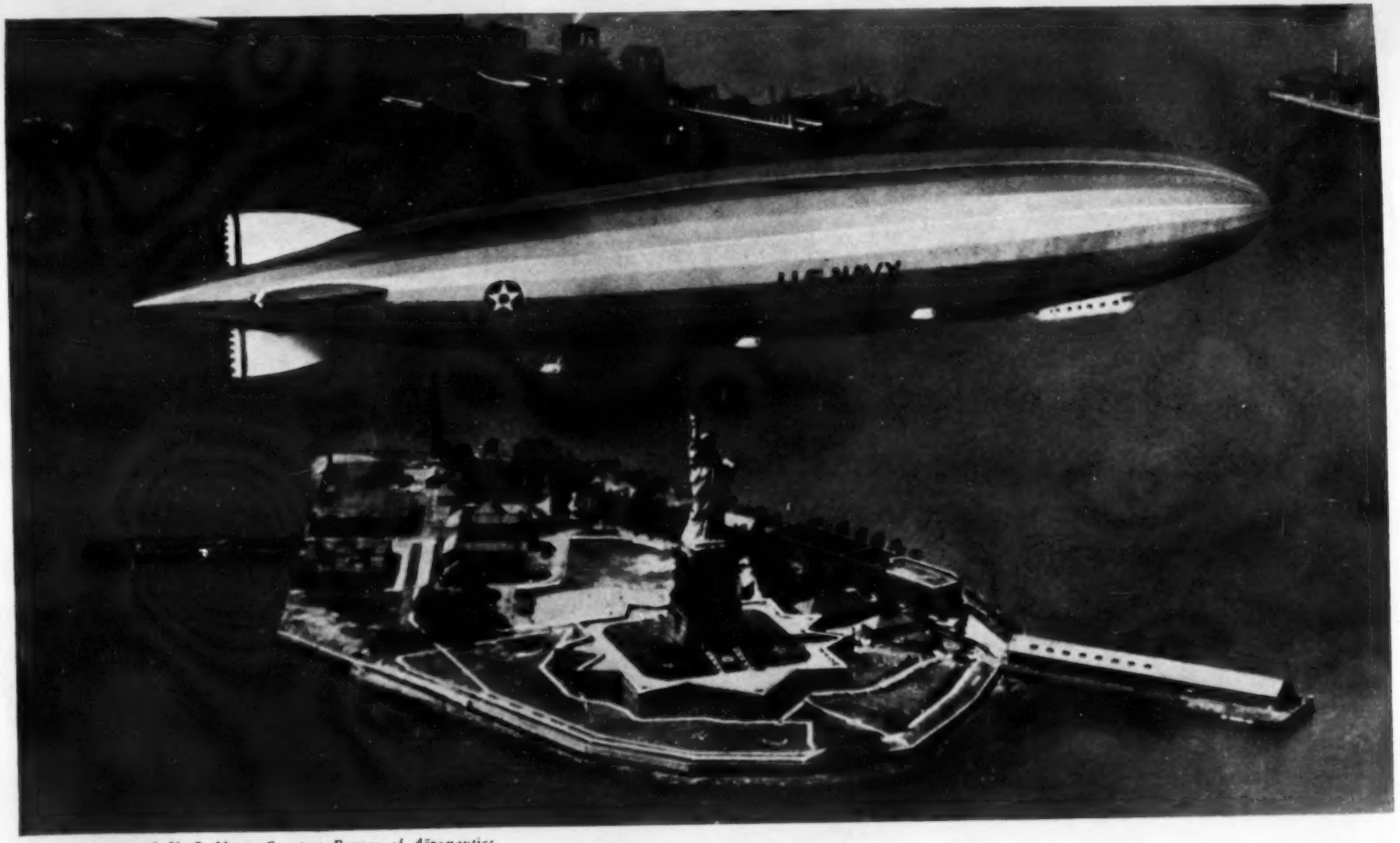
These six ships were recently delivered to the Navy by Chance Vought Corporation.

Official Photograph U. S. Navy, Courtesy Bureau of Aëronautics

THE *LOS ANGELES* TAKES A LOOK AT WASHINGTON

Official Photograph U. S. Navy, Courtesy Bureau of Aëronautics

THE *LOS ANGELES* TAKES A LOOK AT WASHINGTON



Official Photograph U. S. Navy, Courtesy Bureau of Aëronautics

OVER THE STATUE OF LIBERTY

THE OLD WITH THE NEW

International News Photos, Inc.

SECRETARY'S NOTES

Naval Historical Foundation

The Naval Historical Foundation continues its quiet but continuous collection of letters, documents, photographs, and objects of historical interest to the Navy. The Institute's secretary recently received the following:

A recent acquisition of the foundation which was presented by D. Addinell Henson of Bryn Mawr, Pa., consists of thirty-four letters and documents covering the period 1825-49.

The collection which was originally the property of Commander Edmund Byrne, U. S. Navy, was obtained through the interest and efforts of Rear Admiral Elliot Snow.

The list included commissions signed by Presidents James Monroe, Andrew Jackson, and John Tyler.

The later dates cover Commander Byrne's cruise in command of the *Decatur*, a unit of the West African Squadron which, commanded by Commodore Cooper, was engaged in the suppression of the slave trade. One of those documents is a copy of the declaration of blockade of the west coast of Africa by Commodore Sir Charles Hotham, H.M.S. *Penelope*, commanding the British West African Squadron, which was engaged upon the same mission.

The Naval Historical Foundation hopes that members of the Naval Institute will continue their interest; and, whenever opportunity offers, lend their assistance to the foundation.

"Watch Officer's Guide"

Reports from this book, which the Institute published last year, have been very favorable. Copies are available at $2.00 each ($1.80 to members of the Institute).

Professional Notes

Many members feel that the Professional Notes section is the most valuable part of the PROCEEDINGS. The editorial staff, by reading about eighty publications, home and foreign, is able to bring to the readers of the PROCEEDINGS the more important items from wide fields. This month our members will find therein a section of "Naval Notes" that gives very briefly some current happenings in the navies of the world. We should like the comments of any who are interested, as to the desirability of continuing such summaries.

Omission of Special Information Number

For some years the Institute has published a special information number each October. There have been such few important changes in the past year that the Board of Control, after consultation with the Navy League and the Office of Naval Intelligence, decided that it would be unnecessary to put out such an issue this year.

Change of Type and Paper

The September issue will be published with a change in type and paper. The secretary hopes that members will give him the benefit of their criticisms, destructive or otherwise. The quality of the paper will be

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International News Photos, Inc.
SEP 1 1931

improved and the type somewhat larger. This should make reading easier but will result in a slight reduction in the amount of matter published.

"Some Stories of 'Old Ironsides'"

The Institute has just published a little pamphlet, written by Commander Frost, about the *Constitution*. The stories are based on that excellent book, *We Build a Navy*, with which most Institute readers are familiar. The booklet is of thirty-two pages with eight pages of illustrations. It is to be sold by the ship's service of the *Constitution*, or may be ordered from the Institute at $.25 a copy. Incidentally, copies of *We Build a Navy* are still available at $4.00 (10 per cent less to Institute members).

Subscriptions

In these days when many people feel that no immediate menace of war exists, when memories of the last war are growing dimmer, and when discussions of war debts and taxes are so much in evidence, it would be advantageous to the Navy if our fellow-citizens were more familiar with the place of the Navy in national and international affairs of the country. Some of our members have felt that the articles, discussions, and notes in the Institute PROCEEDINGS would help to increase this familiarity; and have accordingly paid for subscriptions to the home-town public or school library. Are there others who would like to take similar action?